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Cuatro Vientos: A Reconsideration of Seven Prehistoric Sites in the Lower Rio Grande Plains of South Texas

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CUATRO VIENTOS - A RECONSIDERATION OF SEVEN PREHISTORIC SITES IN THE LOWER RIO GRANDE PLAINS OF SOUTH TEXAS

WEBB COUNTY

TxDOT CSJ No. 0086-14-025
TxDOT Work Authorization No. 575 24 SA007

Prepared for

TEXAS DEPARTMENT OF TRANSPORTATION
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Forward

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Introduction

With this report, Texas Department of Transportation (TxDOT) begins a reconsideration of approaches to the evaluation and treatment of those areas where surface lithic scatters are the main constituent of the archeological record. The reconsideration was inspired by the Cuatro Vientos project in Laredo, Webb County, Texas. The project and the ideas surrounding it developed slowly. The ideas continued to evolve through discussion between SWCA Environmental Consultants (SWCA) and TxDOT as additional work on the project occurred. Because this project proceeded in an idiosyncratic fashion, some words of explanation might be helpful. The following discussion provides an account of how the project developed and where future work might be heading.

Previous Work at Cuatro Vientos

Blanton and Associates (Blanton) conducted the initial survey of the project's area of potential effects (Ringstaff et al. 2004). The survey identified 14 sites. The Blanton survey report showed the local archeological record to predominantly be a messy landscape of mixed assemblages. Within this landscape were some pockets with potentially-preserved, isolable components and features. The Blanton survey report thus recommended eight of the 14 sites for additional evaluation. TxDOT, in consultation with the Texas Historical Commission, accepted those recommendations.

TxDOT then tasked SWCA with developing a scope for the fieldwork under one of TxDOT's general archeological services contracts. SWCA's approach concentrated on the identification of those select areas that had a high level of integrity, with horizontal and/or vertical separation of assemblages and components (Carpenter, Houk, and Miller 2005). This integrity-focused approach has been explicitly advocated by TxDOT in the past and continues to inform TxDOT's evaluations of the effects of its projects.

Integrity and the Evaluation of South Texas Sites

The integrity-focused approach can perhaps be refined, however. Two issues must be addressed. On the one hand, the archeological record of south Texas and its upland lithic scatters is not amenable to many interpretive strategies. The data from the uplands are typically of poor quality. In many places, the ground surface has remained stable or has eroded. Preservation of many types of material is poor. The same general areas have seen repeated occupation. This combination of factors has produced an archeological record that can be difficult to render meaningful. Many aspects of past human behavior and adaptations can not be inferred under these circumstances. On the other hand, the activities that occurred in these areas may have played a significant role in local adaptations. We should not be willing to treat such a large portion of the archeological record as a black box, where significant activities remain unidentified. To ignore the uplands makes an appreciation of the valley settings more difficult, since data would not be available from the upland areas for comparative analysis. Refining current approaches means splitting the difference between asking too much of the existing record and asking too little. Some existing guidance can assist in these efforts.

The regulations that govern the evaluation of archeological sites (36 CFR 60.4) list seven aspects of integrity: location, design, materials, workmanship, association, setting, and feeling. The National Park Service has produced guidance that explains how to apply these aspects of integrity to the characteristics of archeological sites (Little et al. 2000). To summarize this guidance, four aspects of integrity—location, design, materials, and association—are particularly relevant for the evaluation of archeological sites. These aspects of integrity characterize the spatial arrangement of a site and its constituent elements, the preservation of materials at the site, and the ability of the site's data to be linked to important research questions. The importance of these aspects is relative to the kind of research questions being asked.

If integrity could be measured on an absolute scale, many south Texas sites would likely be regarded as having "low" integrity. Such lithic landscapes are not often considered to have sufficient integrity to be able to address important questions of history or prehistory. An integrity-focused approach potentially generates a picture of past adaptation that is focused on those areas that were likely to be buried and preserved. Such a picture often amounts to an archeology of material near rivers and creeks, where alluvial and colluvial processes were the primary depositional processes in operation.

Integrity is not, however, measurable in an absolute sense. Site integrity should be evaluated relative to the data needs of particular research questions. Some questions might require the spatial arrangement of artifacts to have been preserved as humans originally deposited them to within a meter or less horizontally and to have been minimally moved vertically. Other questions might be answerable at much more coarse scales of spatial resolution.

Some Possible Research Questions

Several questions appropriate to the south Texas archeological record come to mind. These questions can be addressed with artifact and feature data from upland sites, because the individual artifact, individual feature, or the site as a whole is a suitable unit of analysis for them. The questions concern the manner in which hunter-gatherers adapted to challenging local conditions. The archeological record suggests that this adaptation endured over a long period of time across a large area, which may indicate that the constituent elements of this adaptation could be used flexibly in a variety of settings.

Stability seems to characterize the material culture employed in south Texas. Artifact types in south Texas, such as projectile point types, changed slowly compared to similar types in central Texas. The persistence of these south Texas types may be attributable to the wide range of functions that the tools could perform. Compared to tool types in central Texas, tool design may vary less among different use contexts. Using chronologically-diagnostic artifacts, these questions could be addressed through use wear analyses, quantitative study of variability in tool form, and a systematic examination of the settings at which tools of different types were discarded.

Local hunter-gatherers likely solved many adaptive problems by moving to more favorable spots. Water was undoubtedly a limiting resource for occupation in south Texas, as it is elsewhere, so the availability of water may have acted as a constraint on group mobility. The duration and intensity of occupation between valley and upland settings may reflect such constraints.

Some material correlates of occupation duration and intensity exist. All other things being equal, the longer a group settles in one spot, the larger the number of tools they will discard and replace at that location. The relationship between discarded, chronologically-diagnostic lithic tools and lithic production debris should thus vary between valley and upland sites. In the water-poor uplands, tools should be more likely to be discarded at a site different from the location at which they were made. In valley settings, tool production and discard should be more likely to occur at the same site. Of course, different tool types will vary in their likelihood of being taken off-site, so the comparison should distinguish those tools likely to be curated from expedient tools. The proportion of tools made and discarded on-site may nevertheless reflect the intensity of on-site activity.

Sufficient variability in stone raw material exists in the Rio Grande region that differences in the production and discard of tools may be evident from patterns in the nodules represented among the debitage and finished tools. Tools made in one location and discarded at another spot may be identifiable by the raw material from which those tools are made. This non-local raw material may be distinctive from the raw material of debitage reflecting on-site tool production.

Feature data should also reflect patterns of mobility and occupation. Lengthy or repeated occupations should be more likely to occur in favorable valley settings than in most upland spots. Thus, upland features should show less evidence of re-use. Re-use should be identifiable from more complete fracturing of rock, larger features, and an increased likelihood of multiple radiocarbon ages being associated with the feature. As long as the hypotheses do not concern the frequency of occupation, variable preservation of these features among different settings should not affect the ability of those hypotheses to be evaluated.

Such research questions do not require a high level of integrity. For this reason, they may be appropriate to sites like those identified during the Cuatro Vientos project. A serious evaluation of this proposal requires that it be implemented on a fairly broad scale. The work done for the Cuatro Vientos project has made an initial attempt to capture some relevant data.

Testing and Additional Research at Cuatro Vientos

As suggested earlier, SWCA's testing project at Cuatro Vientos focused on the identification of those portions of the archeological record with the most potential for the preservation of buried living surfaces. TxDOT obtained access to seven of the eight sites that required evaluation. SWCA directed their mechanical trenching and unit excavation within these sites to settings favorable for sedimentary deposition. Additional, supplementary field work requested by TxDOT also explicitly addressed the surface component of the archeological record.

TxDOT obtained an Antiquities Permit from the Texas Historical Commission to implement an experimental research design in conjunction with SWCA's work at Cuatro Vientos. While SWCA's staff conducted the fieldwork, TxDOT directed this supplementary investigation. SWCA re-surveyed several sites and identified diagnostic artifact types. They placed surface collection units over those artifacts and collected all of the artifacts within the unit. The purpose of this work was to better characterize the lithic landscape, to quantify "background noise" in lithic production and tool use, to clarify the relationship between diagnostic artifacts and debitage, and to obtain a more robust sample of diagnostic artifacts for analysis of use wear and tool form. Analysis of TxDOT's work is ongoing, so results are only available for SWCA's portion of the investigation.

SWCA recommended that none of the seven tested sites be considered eligible for inclusion in the National Register of Historic Places and that those sites did not warrant formal designation as State Archeological Landmarks (Carpenter, Chavez, et al. 2005). SWCA found that most sites occurred in disturbed contexts and contained little data with sufficient integrity to address important questions regarding prehistory. TxDOT agreed with these conclusions for archeological sites 41WB572, 41WB621, 41WB622, and 41WB623.

A few sites—41WB441, 41WB577, and 41WB578—contained relatively intact features in "isolated pockets of integrity", but they did not occur in association with broader living surfaces. Consequently, SWCA also regarded these features as not possessing sufficient data to address important research questions about prehistory. TxDOT disagreed with the conclusions regarding these three sites.

Sites 41WB441, 41WB577, and 41WB578 had intact features that could provide data addressing important questions about prehistoric settlement decisions. The features seemed to reflect short-term use of the upland landscape by very mobile hunter-gatherers, as would be expected in areas where resources have a relatively even distribution. Valley settings might be expected to produce a different pattern of mobility and thus of feature construction, function, and use. Indeed, some previous studies provide tentative support for these interpretations (see review in Miller et al. 2000: 9-13). This hypothesis could be further evaluated with the data from the Cuatro Vientos sites when compared to data from other settings.

Testing such hypotheses does not require substantial, preserved living surfaces with associated artifacts and features. They mainly require the observation of similarities and differences in feature characteristics among different landforms. The features must also contain material that allows them to be placed within a chronological framework. The presence of datable material that can be associated with the remnants of a particular feature satisfies the integrity requirements for many research questions. As long as a sample of such features from different landforms exists, hypotheses about settlement should be testable.

The dated features from the Cuatro Vientos sites seemed to be relatively isolated, based on extensive trenching at these sites. Thus, TxDOT recommended that sites 41WB441, 41WB577, and 41WB578 be considered to be eligible for inclusion in the National Register of Historic Places and to warrant formal designation as State Archeological Landmarks. TxDOT also proposed, however, that the data potential of these sites had been exhausted during the course of the fieldwork for the testing program. TxDOT therefore recommended that no further fieldwork occur at these sites. The data from sites 41WB441, 41WB577, and 41WB578 was to be reported in a greater level of detail than the data from the other sites. THC concurred with this proposal. Thus, TxDOT charged SWCA with developing a framework for the interpretation of these sites.

This framework was to take the form of a historic context for the lower south Texas plains. To this end, SWCA collected data from Webb County, Zapata County, and northern Starr County, focusing their initial efforts on feature types and their distribution. The purpose of this preliminary study was to demonstrate the potential of datable features like those found by SWCA at Cuatro Vientos to address broad but important questions about the settlement and adaptations of south Texas.

SWCA gamely compiled available information for all recorded sites in the study region. This effort exposed the limitations of previous work. Feature characteristics of interest—such as feature size, feature type, and associated materials—were inconsistently reported. The amount of usable information was not commensurate with the number of cultural resource studies that have occurred. Based on this work, SWCA gave a presentation to THC and TxDOT that summarized their findings, discussed some preliminary observations and patterns, and proposed a plan for advancing the study.

Reluctantly, TxDOT decided not to develop the historic context more fully at that point. Given all the gaps in basic data for the region, definition of property types and standard approaches to their evaluation and treatment seemed a little premature. TxDOT thus tasked SWCA with completing their report, demonstrating the utility of the historic context for addressing important questions by applying it to the Cuatro Vientos data.

TxDOT also asked SWCA to compare the findings and recommendations derived under their original research design with the findings and recommendations generated from the historic context. Based on this comparison, SWCA was to provide recommendations for appropriate scopes of work during survey and testing in the south Texas plains. These recommendations were to identify questions that are important for an understanding of the prehistory of the south Texas plains, types of data that seem likely to address these questions, and field and laboratory methods appropriate for addressing the questions. This volume concludes with the results of this introspection.

Prospects for a Different Approach to Management of the Archeological Record in South Texas

SWCA's work shows that interesting, important things can be learned about past adaptations even at sites that have been affected by many different depositional and post-depositional processes. Features and artifacts can be situated on the landscape and compared to each other. Patterns in the distribution and form of Nueces tools and burnt rock features, for example, hint at significant variability in the organization of activities and the intensity of those activities. Such advances are possible when the site is not the sole unit of analysis. SWCA's results support further development of the historic context.

Given the inherent limitations of SWCA's work and the current, incomplete status of TxDOT's related studies, any definitive conclusions are certainly premature. TxDOT offers a few suggestions at this point. The goal of TxDOT's work is to develop and obtain approval for a programmatic approach to meeting compliance obligations in this region.

Such a program would specify the particular methods and observations to be employed at archeological sites. Work conducted under the program would be "pre-approved" as the appropriate method for dealing with any adverse effects that a project may have on historic properties. Thus, all fieldwork could be handled in single phase, conducted at any point prior to construction. The work done to this point provides some indication of the methods and observations to be taken under the agreement.

Clearly, the use of a variety of units of analysis will be an important part of the methods. The regulatory structure within which cultural resource studies are conducted typically utilizes the site as a unit of management. A site-focused approach to the recording and management of cultural resources will likely be retained by necessity and for convenience. Isolated features and artifacts within those sites, however, also have independent utility for addressing certain research questions. Recording this data need not imply that a tremendous amount of additional time and money has to be devoted to investigations. SWCA recovered relevant artifact and feature data without much modification to their usual fieldwork approach.

The observations made on artifacts, features, and sites may nevertheless differ from the observations that are typically made. A lot of these observations could be taken using a relatively modest level of effort. A few simple observations could be made on features, for example, such as the total feature weight and the size-frequency distribution of rock fragments from the feature. For formal, chronologically-diagnostic tools, routine documentation of tool location, tool attributes, and use wear may also be undertaken.

If archeologists can agree on the questions of interest and observations to be taken that address those questions, a considerable amount of progress could be made. As SWCA note in this volume: "….the objectives would be to create a system of archaeological investigation whereby each individual project is incorporated into a larger system and aggregation of effort creates a cumulative comprehension of exceedingly complex landscapes". The archeological record of the region needs widely-shared standards for data collection and a unifying historic context to make sense of it. This volume represents a tentative step in that direction.

References Cited

Carpenter, S., M. Chavez, K. A. Miller, and M. Bonine
2005 Draft Interim Report of Significance Testing on Seven Sites in the Cuatro Vientos Roadway Project, Webb County, Texas. Texas Antiquities Permit 3755. SWCA, Inc., Austin, Texas.

Carpenter, S., B. Houk, and K. A. Miller
2005 Research Design and Work Plan for Significance Testing Investigations on Eight Sites on the Cuatro Vientos Roadway Project, Webb County, Texas. Texas Antiquities Permit 3755. SWCA, Inc., Austin, Texas.

Little, B., E. M. Seibert, J. Townsend, J. H. Sprinkle, Jr., and J. Knoerl
2000 Guidelines for Evaluating and Registering Archeological Properties. National Register Bulletin Number 36. Cultural Resources, National Park Service, U.S. Department of the Interior. Washington, D.C.

Miller, K. A., S. Carpenter, L. C. Nordt, and C. W. Ringstaff
2000 Archaeological Investigations along the Camino Columbia Toll Road, Webb County, Texas. Prepared by SWCA, Inc., Austin, Texas. Prepared for Camino Columbia, Inc., Laredo, Texas.

Ringstaff, C. W., D. O. Brown, and J. T. Jones
2004 Cultural Resources Survey of the Proposed Cuatro Vientos Roadway Right-of-Way Expansion, Webb County, Texas. Texas Antiquities Permit 3502. Blanton and Associates, Inc., Austin, Texas.

ABSTRACT

On behalf of the Texas Department of Transportation (TxDOT), SWCA Environmental Consultants (SWCA) conducted testing investigations on seven prehistoric sites located within the Cuatro Vientos roadway project right-of-way in Webb County, Texas. The test excavations, conducted in June 2005, were performed in compliance with the National Environmental Protection Act (NEPA), National Historic Preservation Act (NHPA), and the Texas Antiquities Code. The work was designed to assess each site's potential for listing on the National Register of Historic Places (NRHP) and for designation as State Archeological Landmarks (SAL). The work was performed under Texas Antiquities Permit No. 3755 with Kevin A. Miller serving as Principal Investigator. Field investigations were performed under TxDOT Work Authorization No. 573 26 SA007 of the SWCA/TxDOT General Services Contract 573 XX SA007.

The seven tested sites are distributed primarily within the drainage basin of San Idelfonso Creek, a tributary of the Rio Grande in south Texas. The sites, including 41WB441, 41WB572, 41WB577, 41WB578, 41WB621, 41WB622, and 41WB623, are all prehistoric open sites situated in both buried and surficial contexts on terraces and adjacent uplands. The sites principally consist of various prehistoric features and artifacts associated with lithic procurement locales and open occupations. According to the temporal data, the sites contain occupational components from the Middle Archaic through Late Prehistoric, though Late Archaic components are the most prevalent throughout the project area.

Because of poor preservation and the lack of integrity, SWCA did not recommend any of the sites as eligible for the NRHP or as SALs. TxDOT, however, did not concur and recommended three as eligible, though all were effectively mitigated by the testing investigations. This difference of opinion formed the basis for developing a different approach to the assessment of the south Texas archaeological record. In essence, this project is a reconsideration of evaluations of significance and research potential of seven sites, specifically addressing the well-known problems with the regional archaeological record, namely erosional or stable settings that create mixed or incomplete assemblages. The proposed solution is the development of a contextual frame of reference, utilization of specific point-plotted data in addition to the site construct, and variable temporal scales.

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MANAGEMENT SUMMARY

Project Title: Cuatro Vientos: A Reconsideration of Seven Prehistoric Sites in the Lower Rio Grande Plains of South Texas.

SWCA Project Number: 14565-126-AUS.

TxDOT CSJ Number: 0086-14-025.

Project Description: The Laredo District of TxDOT, in conjunction with Webb County, the City of Laredo, and the Federal Highway Administration (FHWA), proposes to construct an urban arterial road on a new location to the southeast of the City of Laredo. This undertaking, called Cuatro Vientos, would comprise a six-lane highway that will extend for 7.24 miles and include the construction of roadway, storm sewers, two bridges, and an overpass. Overall, the Area of Potential Effects (APE) is 7.24 miles (11.6 km) by 400 feet (122 m) in width, or roughly 350 acres. The archaeological investigations were limited to seven spatially discrete sites within this overall APE.

Location: The Cuatro Vientos project area extends from the headwaters of San Idelfonso Creek to uplands near its confluence with the Rio Grande, south of Laredo, Webb County, Texas. The sites are situated on a mixture of privately owned lands that will be acquired by the state as well as public property owned or controlled by TxDOT. The sites appear on the Laredo East and Laredo South, Texas USGS 7.5-minute topographic maps.

Sites Investigated: Sites 41WB441, 41WB572, 41WB577, 41WB578, 41WB621, 41WB622, and 41WB623.

Principal Investigator: Kevin A. Miller.

Texas Antiquities Permit: 3755.

Dates of Work: May and June, 2005.

Purpose of Work: As the construction project will involve federal funds from the FHWA and involves state land controlled by the Laredo District of TxDOT, investigations were conducted in compliance with the Texas Antiquities Code; the NHPA; the Programmatic Agreement between the FHWA, the Advisory Council on Historic Preservation, TxDOT, and the Texas Historical Commission (THC); and the Memorandum of Understanding between TxDOT and the THC.

Curation: The artifacts and records from the project will be curated at the Texas Archeological Research Laboratory, The University of Texas at Austin under Texas Antiquities Permit 3783, for which Scott Pletka serves as Principal Investigator.

Comments: Sites 41WB441, 41WB577, and 41WB578 were recommended by TxDOT as eligible for the NRHP and listing as SALs. The sites, however, were mitigated by the investigations reported here, and no further work is recommended. Sites 41WB572, 41WB621, 41WB622, and 41WB623 are not recommended as eligible for the NRHP or as SALs, and no further investigations are recommended.

Chapter 1

The Cuatro Vientos Project - Introduction

Introduction

Cuatro Vientos is a linear roadway project that crosses eroded desert uplands and alluvial terraces south of Laredo in Webb County, south Texas. The right-of-way forms a transect from the headwaters of San Idelfonso Creek to near its confluence with the Rio Grande. Of significance, this configuration provides a cross-section of the landscape, allowing a consideration of archaeological patterns across the local ecological spectrum.

SWCA's archaeological testing investigations along the roadway project began in 2005 as a rather straightforward assessment to determine the research potential and significance of seven prehistoric sites in Webb County, Texas. Because of several factors, most notably the ubiquitous lack of contextual integrity, SWCA did not recommend any of the seven sites for listing on the National Register of Historic Places (NRHP) or as State Archeological Landmarks (SAL). Texas Department of Transportation (TxDOT) archaeologists, however, differed and recommended three of the seven sites as eligible. Based on these differences, the project evolved into a reconsideration of the prevailing approaches to south Texas archaeology. Specifically, the research question was posed: given the ubiquity of contextual problems in the region, could a different perspective yield new interpretive directions? This study, accordingly, is a concerted effort to develop an analytical tact that, while fully incorporating the inherent problems in the regional sites, reconsiders the possibilities in the archaeological record of the Lower Rio Grande Plains.

Project Description

The Laredo District of TxDOT, in conjunction with Webb County, the City of Laredo, and the Federal Highway Administration (FHWA), proposes to construct an urban arterial road on a new location to the southeast of the City of Laredo. This undertaking, herein called Cuatro Vientos, would comprise a six-lane highway that will extend for 7.24 miles and include the construction of roadway, storm sewers, two bridges, and an overpass.

The proposed Cuatro Vientos undertaking stretches to the north from Mangana-Hein Road to approximately 3,000 feet (914 m) north of the Loop 20/US 359 intersection in the City of Laredo, Texas. The entire proposed right-of-way is private property that will eventually become state public land. Overall, the Area of Potential Effects (APE) for Cuatro Vientos is 7.24 miles (11.6 km) long and 400 feet (122 m) wide, or roughly 350 acres. Within the Cuatro Vientos right-of-way, the testing program focused on seven sites, or specific portions of the sites as defined by Ringstaff et al. (2004) for additional cultural resources investigations.

Project Overview

On behalf of TxDOT, SWCA conducted archaeological significance test excavations on seven prehistoric sites located within the Cuatro Vientos Road right-of-way that would be constructed south of Laredo in Webb County, Texas (Figure 1.1). Conducted in compliance with the National Environmental Protection Act (NEPA), National Historic Preservation Act (NHPA), and the Texas Antiquities Code, the work was designed to assess each site's potential for listing on the NRHP and for designation as SALs. The work was performed under Texas Antiquities Permit 3755 with Kevin A. Miller serving as Principal Investigator. Field investigations, performed under TxDOT Work Authorization No. 573 26 SA007 of the SWCA/TxDOT General Services Contract 573 XX SA007, were carried out in May and June 2005. The seven tested sites are distributed primarily within the drainage basin of San Idelfonso Creek, a tributary of the Rio Grande in south Texas. The sites include 41WB441, 41WB572, 41WB577, 41WB578, 41WB621, 41WB622, and 41WB623 (Figures 1.2a–1.2b). As a general characterization of the sites,

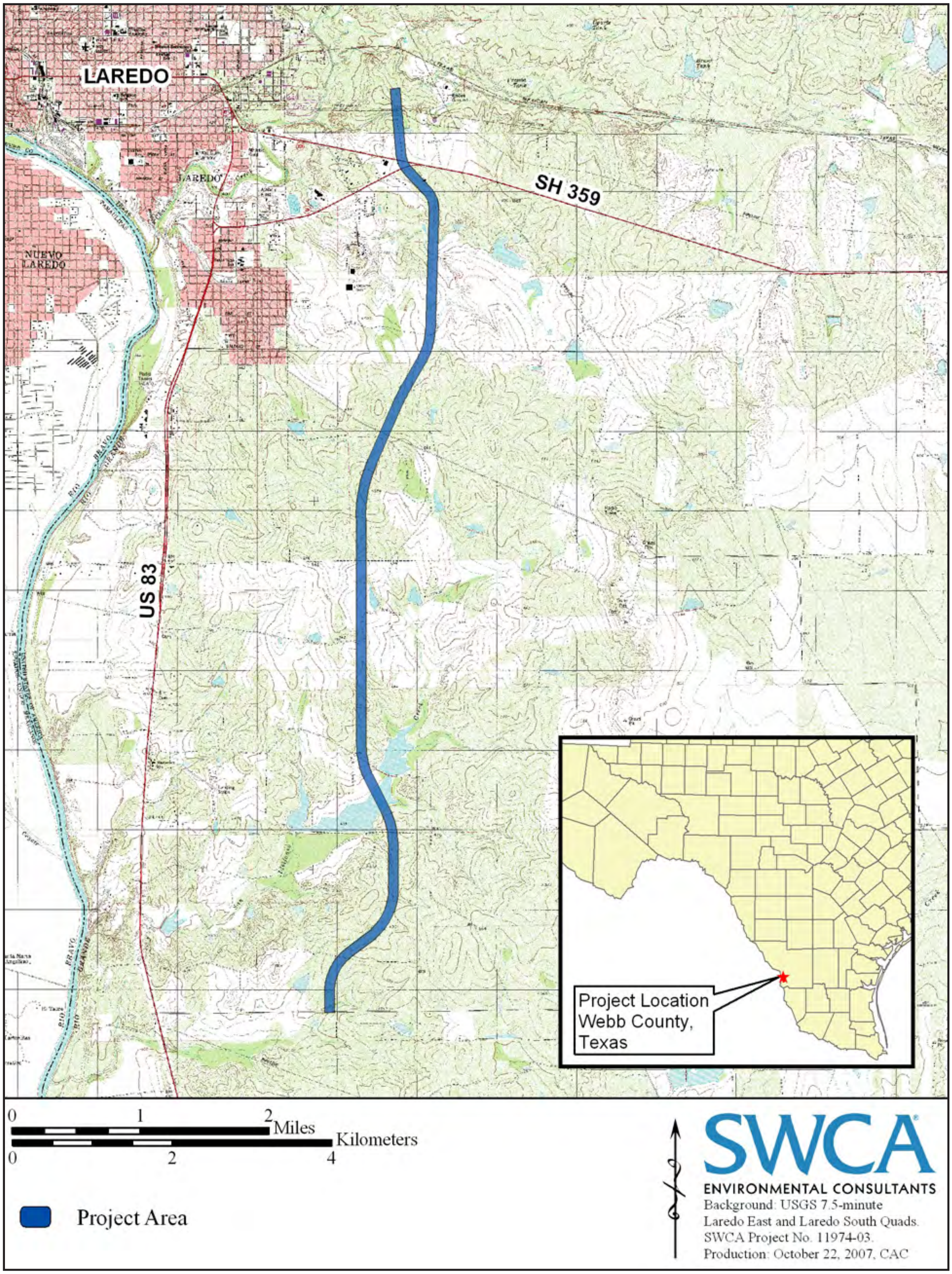


Figure 1.1. Project location map showing 400-foot right-of-way.

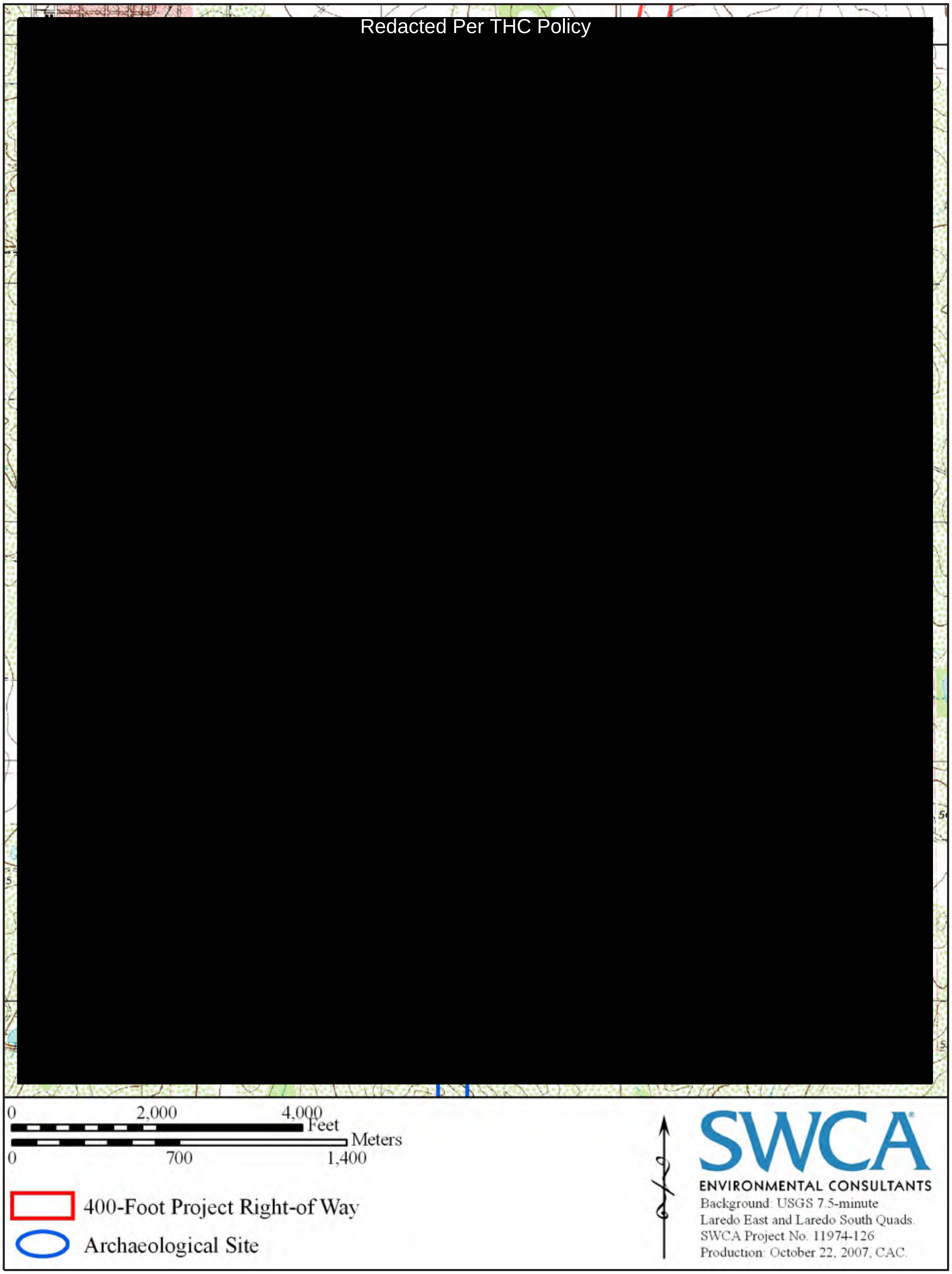


Figure 1.2a. Site location map.

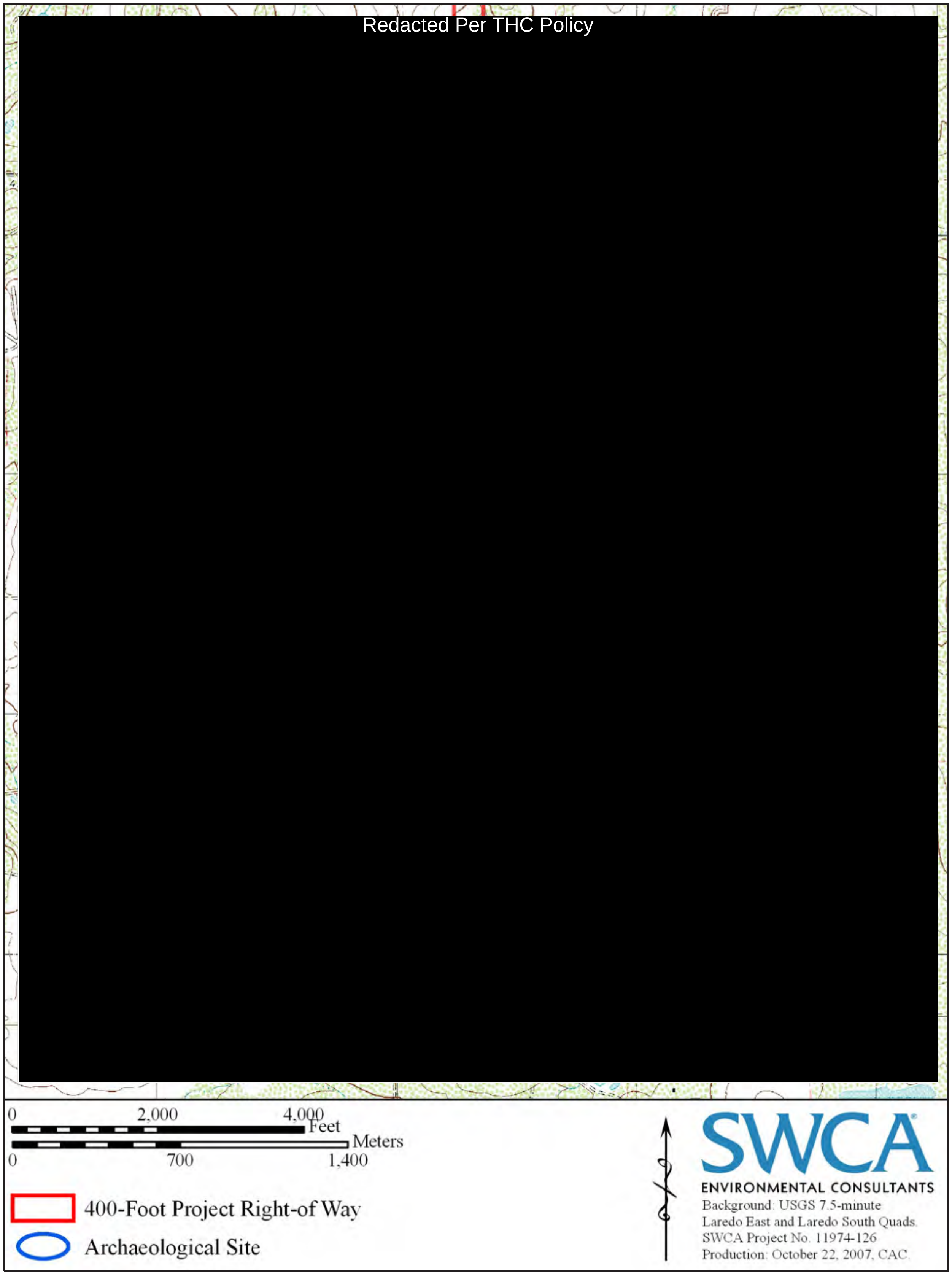


Figure 1.2b. Site location map.

all are prehistoric open sites situated in both buried and surficial contexts on terraces and adjacent uplands. The sites principally consist of various prehistoric features and artifacts associated with lithic procurement locales and open occupations. According to the preponderance of diagnostic artifacts recovered from the sites, Middle Archaic through Late Prehistoric components are represented, though Late Archaic components are the most prevalent throughout the project area.

An interim report on those investigations, prepared to expedite the review and compliance processes for the Cuatro Vientos project, was completed in June 2005 as part of the same work authorization. SWCA did not recommend any of the sites as eligible for listing on the NRHP or for designation as SALs. However, TxDOT did not concur with three of these recommendations, considering 41WB441, 41WB577, and 41WB578 eligible, though the research potential had been exhausted by the testing investigations. This difference of opinion, as mentioned, served as an impetus for a reconsideration of the research potential of sites in the region. It was determined that what was needed was a historic context, a frame of reference for evaluating such potential, and a research design derived from this context.

Accordingly, under Work Authorization 575 09 SA007, SWCA conducted initial stages in the development of a historic context for the Lower Rio Grande Plains, namely the compilation and review of the existing archaeological data, compilation of an annotated bibliography, and the exploratory identification of significant patterns. As originally envisioned, the subsequent step in the context development, which to date has not been conducted, would be to synthesize the data, define regional patterns and problems, develop explanatory models (site distribution and settlement patterns), and derive testable hypotheses and research questions. Concurrently, as part of the process, an assessment of the prevailing archaeology was to have been formulated with the intent of defining realistic approaches to analysis and management of the regional archaeological record and addressing data gaps therein.

In the course of events, however, it was decided that further development of the historic context would be postponed, and the write-up of the seven Cuatro Vientos sites would proceed, considering a few of the approaches devised in the initial stages of the historic context. Prior to the write-up, in late 2006 several explicit research questions were derived from the in-progress context to serve as a research design. Upon approval of these in 2007, under Work Authorization 575 24 SA007, SWCA began the final analyses, which are the subject of this document.

History of Site Investigations

In 2001, Blanton & Associates conducted a survey of the original 200-foot wide corridor, re-documenting two previously recorded prehistoric sites and recording 10 new prehistoric sites (Ralph et al. 2001). Of the 12 sites, three were deemed potentially eligible for listing on the NRHP and, accordingly, were recommended for additional work to determine their eligibility status.

Subsequent to the initial survey, design changes created new right-of-way, and Blanton & Associates again surveyed the project area in 2003 (Brown et al. 2004). This work documented an additional four sites, but also combined a number of the previously recorded sites into single, larger sites (Brown et al. 2004). The net result was the same number of sites within the right-of-way, a total of 12 recorded sites. Five of the sites were recommended for further work to determine their eligibility for listing on the NRHP.

Subsequent to these investigations, the roadway was redesigned to be an urban arterial, a more substantial facility that would consist of a six-lane road with a raised median, overpasses, and interchanges. Consequently, the proposed project area increased from 200 feet to 400 feet in width. Blanton & Associates surveyed the additional right-of-way in 2004, revisiting the 12 previously recorded sites and identifying three new sites (Ringstaff et al. 2004). Two of the previously recorded sites were combined into one site. As a result, to date there are a total of 14 sites within the project area. Eight of the 14 sites were recommended for additional work to determine their potential eligibility for listing on the NRHP. TxDOT recommended that six of the sites (41WB387, 41WB571, 41WB576, 41WB630, 41WB631, and 41WB632) not be considered eligible for listing on the NRHP or designation as SALs. For the other eight sites, TxDOT recommended that they be treated as if they were eligible for the NRHP and designation as SALs unless project impacts could not be avoided, at which time TxDOT would perform testing to confirm their eligibility. THC concurred with these recommendations on January 5, 2005. Lacking access to one of the eight, SWCA tested only seven of the eight sites.

Failure of Traditional Approaches

In South Texas and Webb County in particular, traditional approaches to the archaeological record consistently yielded mixed, but overall rather ineffective results. The Cuatro Vientos study followed several major TxDOT-sponsored projects in Webb County, which had varying success in yielding new and significant information. The best information came from sites with stratified deposits in alluvial terraces, such as the Lino site and to a degree the Boiler site (Quigg et al. 2000; Quigg et al. 2002). While studies of these sites yielded some promising results, other studies, as discussed below, directly contradicted the utility of many of the analytical tacts that appeared to be effective.

Investigation of 41WB556 on Becerra Creek took a critical look at chronology, technology, and subsistence issues and rather systematically identified problems that severely limited interpretation would need to be addressed before any further work was conducted along those lines of analysis (Mahoney et al. 2002). The University of Texas at San Antonio (UTSA) conducted the data recovery investigations at 41WB556, for which they inherited the research design that was fundamentally similar to that utilized on the Boiler and Lino sites. Consequently, UTSA's work was an independent assessment of the methods and objectives used on these other sites. UTSA's conclusions are briefly reviewed here to lay out the basic problems of traditional approaches to the archaeological record in south Texas, to lay out the theoretical and methodological context at the time of the Cuatro Vientos investigations, and to explain the analytical directions of the Cuatro Vientos sites as detailed in this report.

Mahoney et al. (2002) proposed three basic research design components, each of which proved unfruitful to a degree. The first of three research issues was integrity and chronology, and based on 27 radiocarbon dates, the authors concluded: "unfortunately, the charcoal dates were clearly not in context, and therefore we lack any independent way to verify the residue dates. Even discounting the charcoal dates, however, the residue dates are widely scattered for a given feature." (Mahoney et al. 2002:133). Consequently, the chronological parameters could not be determined and the poor integrity precluded drawing conclusions of basic temporal components.

The second research domain of the 41WB556 analysis was burned feature technology. In the final analysis, "the resulting patterns were not straightforward, and the rock weight data from the site are consistent with a number of possible scenarios" (Mahoney et al. 2002:133). Related to this second issue, a consideration of isotopic residue analysis determined that "processing additional archaeological samples will probably not add significantly to our understanding of the relationship between residues recovered from the rock and what was processed with those rocks" (Mahoney et al. 2002:133).

The third domain concerned lithic technology. In the analysis of projectile points, they concluded that "if these forms represent chronological markers of the Middle Archaic (Abasolo, Tortugas) and Late Archaic (Catan, Matamoros) periods, our analysis shows that the large and small types can no longer be used with any degree of confidence as index markers of archaeological components dating to these time periods" (Mahoney et al. 2002:133). Additionally, mixed assemblages precluded a number of other analytical strategies.

The report is laudable for its honest and rigorous evaluation of the data, but the overall effect was rather harsh indictment of some of the primary analytical tacts of the regional archaeology. As they say, the site they assessed "is probably not unlike many sites in similar settings in South Texas" (Mahoney et al. 2002:134), and so the conclusions, to a degree, could perhaps be considered broadly applicable. Mixed assemblages, poor preservation of subsistence and paleoenvironmental data, erosional setting, poor context and integrity, and other problems are pervasive in the region. The Cuatro Vientos sites are similar in many ways to 41WB556 on Becerra Creek, which is the next drainage south of

San Idelfonso Creek, and have many of the common problems of sites in the area.

Consideration of a Different Approach

Emerging from this context, the fundamental objective in the analysis of the Cuatro Vientos sites was to identify a different frame of reference that could tap into potentially significant research avenues. One process in this study involved the initial steps of developing a historic context for Cuatro Vientos by compiling and assessing the archaeological data from Webb, Starr and Zapata counties. In assessing the data, it became rather apparent that although trends in the data at the site level may be ambiguous or problematical, there were other spatial and temporal scales at which any given set of data could contribute. Accordingly, that premise is the basis for the Cuatro Vientos project, notably to develop a theoretical framework for a broader contextual approach to the archaeological record of Webb County.

In the final analysis, as reported here, differing contexts can be utilized to reasonably address some of the inherent problems. The resolution lies in two domains – context of individual data and shifting theories tailored to address differing scales of time and space. Regarding the former, the traditional use of the site construct in many parts of south Texas, though often necessary for managerial purposes, is usually culturally meaningless. A non-site approach is considered for this study. Regarding the latter, the south Texas record, similar to those found in other parts of the world such as Australia and South Africa, is typically rife with contextual problems in which large spans of time are collapsed onto a single surface (Figure 1.3). Certain theories and approaches, usually those that look at whole populations in macro-time rather than those based on individual human motivation or agency, are best suited for these settings.

However, the magnitude of the data loss in such sites ought not be underestimated, and all feasible avenues need to go through, not around, the problems. This report is a test case to assess the feasibility of these approaches.

Structure of Report

This report is structured differently than most for several reasons. As the project evolved, the objectives shifted from merely cultural resource management towards a reconsideration of our own approach, sort of a critical analysis to explore the possibilities. The immediate resource management obligations were largely fulfilled long ago, and the purpose shifted to the question of what, if anything, could further study of the Cuatro Vientos sites contribute to our understanding of human lifeways in south Texas. The limitations of the south Texas archaeological record, most notably the problems of mixed assemblages on non-aggrading surfaces, have been clearly defined and long recognized. SWCA's original recommendations on the eligibility of the Cuatro Vientos sites were made from the perspective of the prevailing approaches and mindset, which offered few viable options for addressing non-trivial,

Figure 1.3. Typical Cuatro Vientos surfacial site with thousands of years of intermixed archaeological debris in a lithic landscape. This landowner, with the help of others, reported collecting "jars and boxes" of artifacts from the site, simply unaware of the information loss.

significant questions about regional prehistory. To the best of our understanding, the commonly expressed regional research questions were rather unassailable given the seemingly insurmountable problems with the Cuatro Vientos data.

So this report is organized to address the issues very directly – to fully illustrate the magnitude of the problems with the archaeological record, but concurrently develop frames of reference that consider various facets of the data. The attempt here is to systematically consider the limitations of the Cuatro Vientos data and that of broader region, and to develop possible solutions, or viable research avenues. Casting about for a simple yet comprehensive framework of the different aspects and objectives of archaeology, James Deetz's (1967) *Invitation to Archaeology* emerged as perhaps the most concise overview (Figure 1.4). The organization of his work includes chapters entitled:

- The Analysis of Form
- Space and Time
- Context
- Function
- Structure
- Behavior

In the years since its publication, these categories still fundamentally cover the principles, methods, and problems of archaeology, and accordingly constitute a sound basis for consideration of the discipline's different aspects. This report is not an espousal or application of Deetz's views. He was a structuralist, and his mentalist concept of culture is pragmatically rather difficult to implement in the Cuatro Vientos data. However, many of his ideas, mainly definitions such as what is meant by "structure" etc., are interwoven throughout this report to maintain the parallelism.

To facilitate this structure, this report is laid out in nine chapters, each of which is designed to establish the problems inherent in each particular aspect and develop a feasible approach that the analysis of the Cuatro Vientos data is intended to implement and illustrate. Several of Deetz's titles are modified, and some liberties are taken in stretching his intended meanings to fit south Texas.

Chapter 2 addresses context, including the physical setting and cultural backgrounds. Chapter 3 includes the standard descriptions of the tested sites, the archaeological investigations, and the materials recovered. Chapter 4 is a discussion of the temporal components, what sort of data is available and a preliminary analysis of its spatial distribution. Chapter 5, combining two aspects of Deetz's approach, includes form and function in an analysis of Nueces tools. Chapter 6 likewise combines considerations of form and function in an analysis of burned rock features. Chapter 7 looks at structure, which relates to the relationships of things and behaviors in time and space. Chapter 8 regards behavior, in this case long-term foraging strategies and settlement patterns through time in the study area. Finally, Chapter 9 utilizes the directions developed in the report to propose specific recommendations and predictions for future work in the region.

Concerning one final note on the report structure, the report is, to a degree, designed to be cumulative. Chapters 2 and 3 provide the basic information on the sites and their context. From this data, the temporal information discussed in Chapter 4 forms the basic chronological framework used throughout the rest of the report. The Nueces tool and burned rock analyses in Chapters 5 and 6 constitute the groundwork for the subsequent interpretive chapters. In that vein, the objective of this report is to develop hypotheses and approaches that can contribute to future investigations as discussed in Chapter 9.

Chapter 2

Context - Physical and Cultural Settings

S. Christopher Caran and Steve Carpenter

Introduction

The Cuatro Vientos sites are situated along San Idelfonso Creek, a relatively small drainage basin that contributes to the Rio Grande in the Lower Rio Grande Plains region of south Texas. The area is along the eastern margin of the Chihuahaun Desert, which is typically considered a semi-arid desert with relatively high interannual variability in rainfall patterns. Deserts are one of the major world habitats, covering approximately 20 percent of the global land area, and human adaptation to these settings has been among the most widely studied.

As Smith and McNees (1999) note, desert societies have formed the basis for the development of structural-functionalist and cultural ecology movement over the last century or so. Steward (1938) defined the generalized forager model of hunter-gatherer societies based on study of the Shoshone and Paiute in the Great Basin of the American Southwest. In the 1960s and 1970s, Gould (1969), Lee and Devore (1968), Lee (1979), Yellen (1977) and others utilized the ethnographic study of Kalahari Bushmen to develop models and methods that address the behavioral and cultural processes of hunter-gatherer societies in both ethnographic and prehistoric groups. Based on these works, the "generalized forager" model defines five basic characteristics: egalitarian society; low population density; lack of territoriality; minimal food storage; and a fluid social structure with high residential mobility.

Throughout the latter part of the Holocene in the Cuatro Vientos area, the desert setting and generalized forager model appear to characterize the region and its inhabitants. However, within these broad perspectives, there was a wide range of variation and independent cultural trajectories. Within these general characterizations are substantial and unique microenvironmental and cultural diversity. The objective of the Cuatro Vientos study is to begin to define the particular variations and patterns in the last 4,000 years of prehistory. This chapter presents the physical and cultural settings of the region, specifically the Lower Rio Grande Plains, to provide a context for the interpretation of the Cuatro Vientos data.

Physical Context

The Cuatro Vientos project setting is an arid landscape east of the Rio Grande with an often complex depositional setting of erosion and aggradation. Like many arid regions of the world, these conditions create a particular set of archaeological problems, most notably ambiguous cultural contexts and states of preservation that result in interpretive limitations.

The project area provides an approximate 7.5-mile north-south transect across the San Idelfonso Creek drainage basin. The seven sites are within the catchment of San Idelfonso and along the drainage divides bordering adjacent drainages. The sites are distributed across both upland and alluvial terrace settings, though these alluvial deposits are very limited in size and depth as they are inset on small upland tributaries. Geologically, the project area traverses the Eocene Laredo Formation (Figure 2.1) (Barnes 1976). This formation is composed of thick, red to brown sandstones with interbedded clays often capped by thin sandy soils. According to Nordt's (2000) geomorphic study on the Camino Colombia Toll Road north of Laredo, most upland soils whether hillslope, flat, or valley, formed directly in the Laredo Formation or El Pico clays. A veneer of historic sediment ranging from a few centimeters to 40 cm in thickness of fluvial and eolian origin buries nearly the entire landscape in the Laredo Formation. A thin band of Holocene-age alluvium is mapped along San Idelfonso Creek in the project area (Barnes 1976). Many of the surrounding hills and hillslopes are capped by abundant silicious gravels that were commonly exploited by the prehistoric peoples of the area for the production of stone tools. Sandstone bedrock outcrops in many locations along the route.

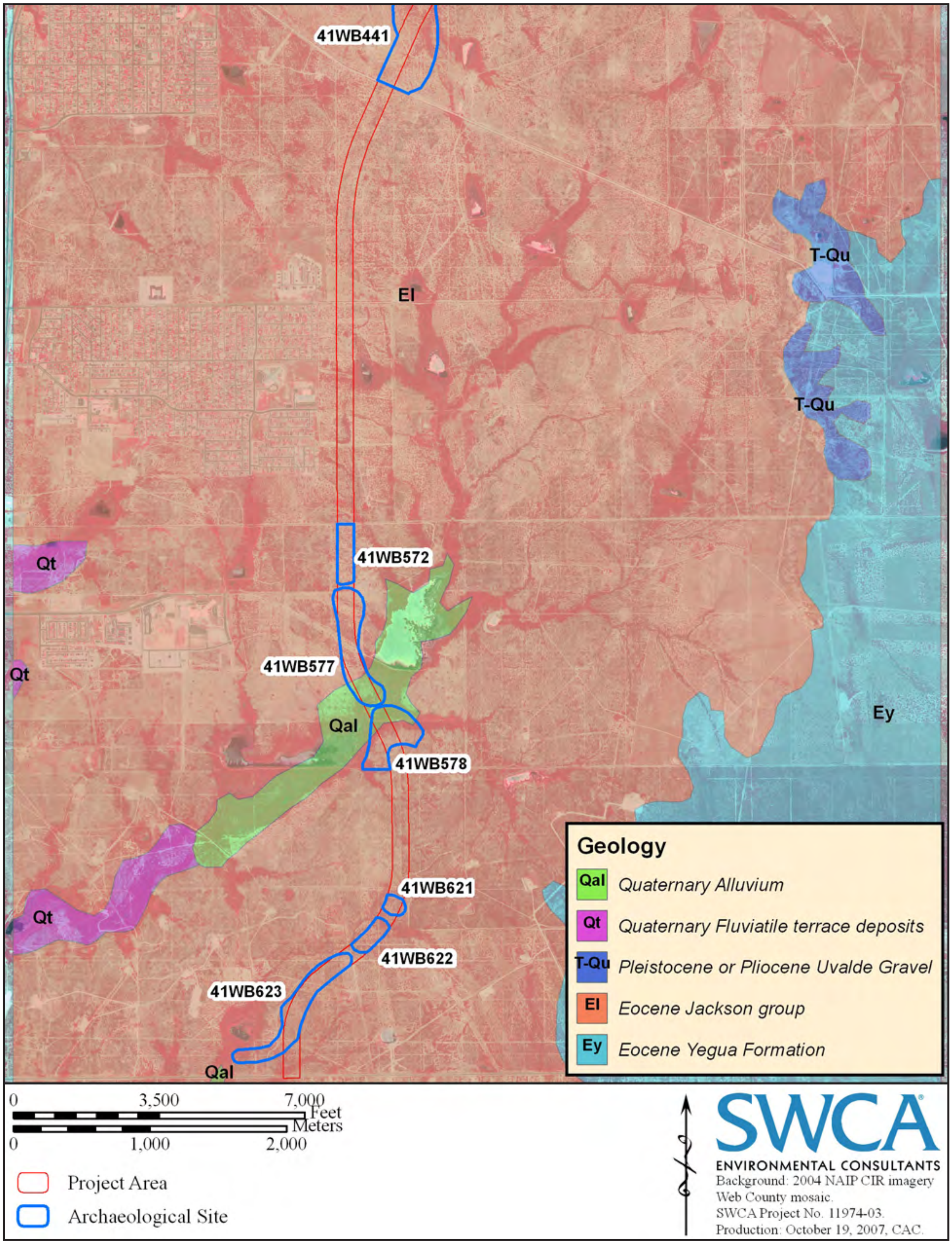


Figure 2.1. Geologic map with sites in project area.

Soils belong to the Copita–Verick association, which are generally loamy soils of widely varying depths and topography (Figure 2.2). Most sites are mapped within Verick fine sandy loams or Copita fine sandy loams, though minor exposures of Tela silty clay loams are also present along the drainage. As evidenced by the Lino site downstream from the project area, Verick and Tela soils have the potential for deep, stratified deposits in very select depositional contexts, particularly closer to the Rio Grande (Quigg et al. 2000). Vegetation across the project area consists of a mesquite and scrub oak overstory with a sparse to occasionally dense Chihuahuan Desert understory of grasses, scrubby plants, succulents, and cacti. Among the principal concerns in addressing the archaeological record in this environment is natural erosion. Modern and historical landuse patterns, such as vegetation clearing, overgrazing, fences, the ever-present senderos or dirt roads, and lowering of the water table, have exacerbated this erosion, thereby directly and indirectly affecting site integrity. Many of the sites in the project area are heavily eroded or are situated on a stable, nonaggrading surface, which has resulted in mixed assemblages from various time periods. As will be discussed below, these aspects of the environmental setting form the basis for a number of research questions such as differential site function and behavior across the landscape.

Resource Structure

To characterize the Lower Rio Grande Plains environment, as is generally true of desert settings, the resource structure is "patchy" – at least spatially. Resources are often concentrated along riparian zones, with uplands having very diffuse subsistence materials. Temporal variation is relatively less pronounced since seasonality in south Texas is limited compared to northern latitudes. Nevertheless, there is distinctive seasonal availability to some resources such as pecans and prickly pear tunas, which may have been sufficiently substantial resources to justify extensive seasonal movement as the ethnohistorical record suggests (Campbell 1983; Campbell and Campbell 1981).

To some extent, reliable water sources were spatially concentrated, resulting in "tethered" mobility patterns for people and many animal species. The region, situated on the margin of the Chihuahuan Desert, was subject to the ebb and flow of desertification. These environmental changes significantly affected the resource structure. During wetter times, there was a more homogenous distribution of resources across the landscape.

Though a clear consensus on the timing and magnitude of paleoenviromental change has yet to be reached, a review of the different lines of evidence in central and portions of south Texas and the Lower Pecos area indicate a few broad trends are rather commonly accepted (Decker et al. 2000). From about 5,000–2,500 B.P. the setting was arid, the high point of the Altithermal, which would have circumscribed riparian zones. From about 2,300 B.P. onward was relatively wetter except from about 1,000 or 1,200 B.P., when hot, dry climate returned for several hundred years.

Geomorphic Context

The proposed route of the Cuatro Vientos Roadway lies primarily within the San Idelfonso Creek drainage basin, but includes parts of the contiguous watersheds of Chacon Creek to the north and an unnamed tributary of the Rio Grande to the south (Figure 2.3). Most of the project area is moderately dissected rolling to gently sloping terrain. Upland surfaces include: local outcrops of weathered bedrock (sandstone, shale, thin-bedded to nodular limestone, and gypstone of the Eocene Laredo Formation); remnants of Rio Grande terrace deposits (Pleistocene fluvial gravels) capping the drainage divides; degrading concave slopes with a sparse cover of lag gravels (reworked terrace gravels and fragments of local bedrock); and aggrading to essentially stable convex slopes mantled with concentrated lag gravels and thin fine-grained colluvial deposits incorporating at least some eolian sediment. Eolian deposition was probably minimal. Desert varnish covers the exposed bedrock, terrace deposits, and lag-gravel concentrations. The colluvial deposits are partly covered with mats of soil algae (*Nostoc* sp.), which reduce erosion.

All landforms are subject to limited sheet erosion, whereas rills and gullies have developed where the natural vegetation and soils have been disturbed through intensified land use (Figure 2.4). The streams are intermittent, but thin to moderately thick (≤ 4 m) Holocene overbank deposits and bedload underlie the flat valley bottoms. Some small headwater streams

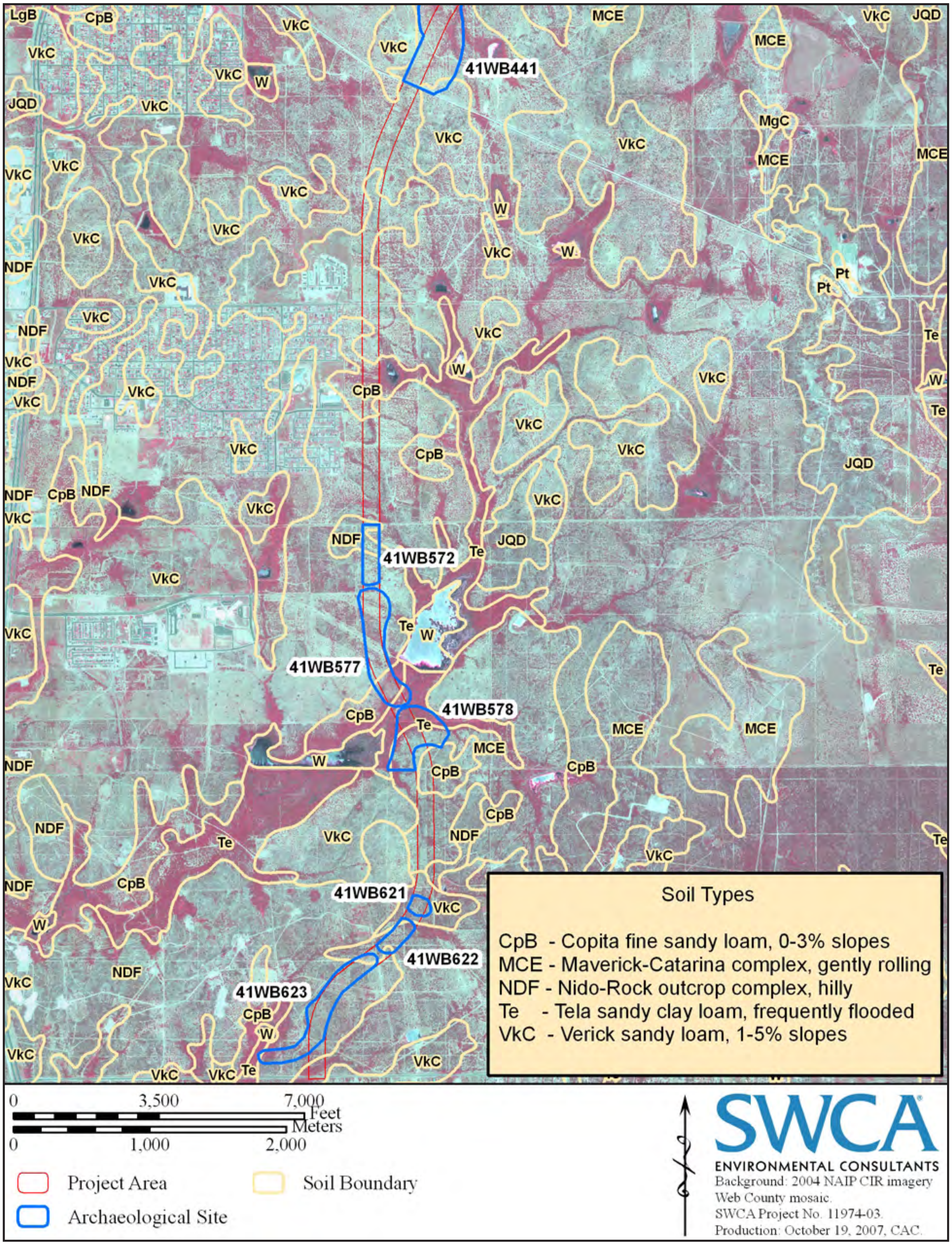


Figure 2.2. Soils map with sites in project area.

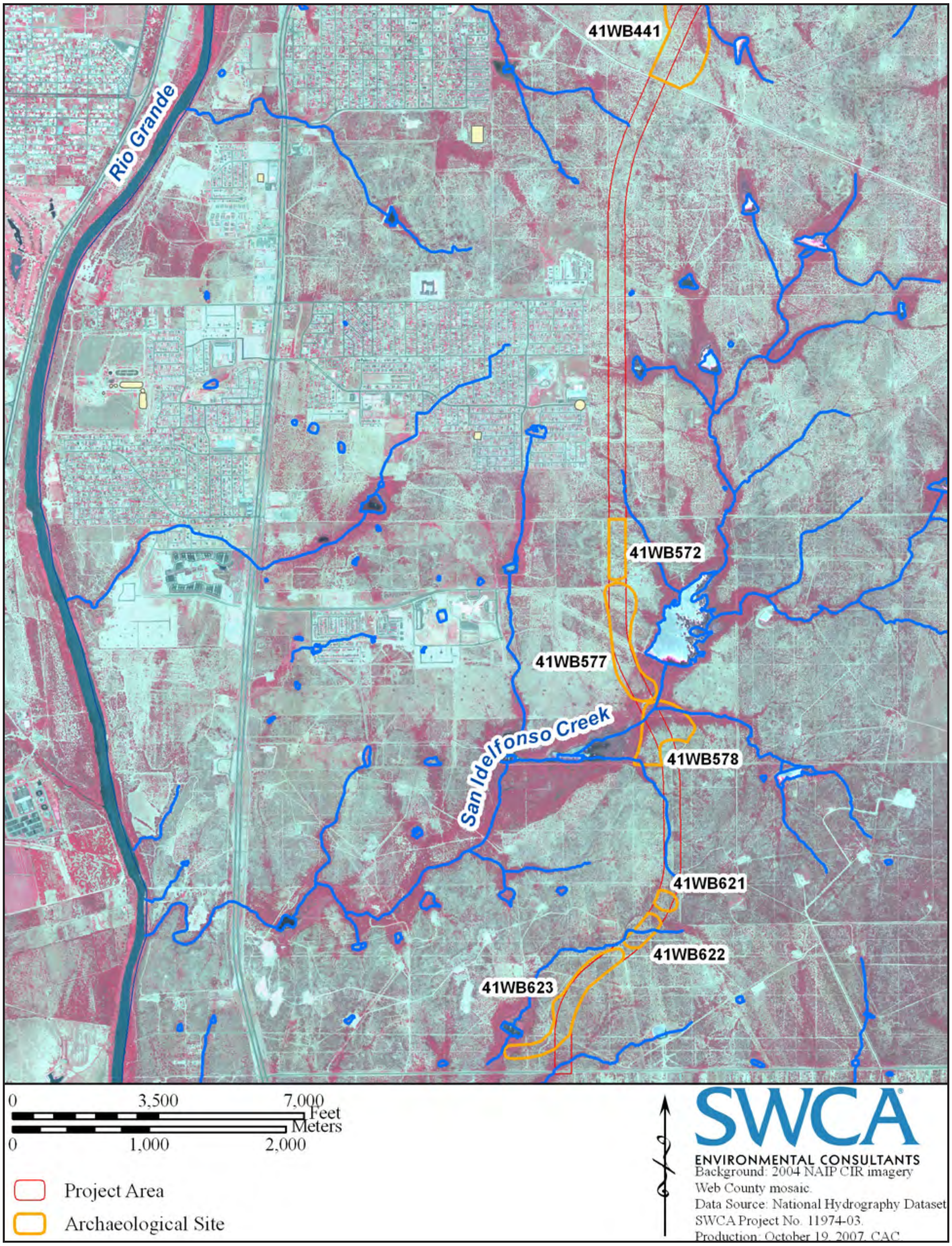


Figure 2.3. Major drainages in the project area.

Figure 2.4. Evidence of sheet wash – a large rock pedestalled by erosion on 41WB572.

have narrow, vertically accreting floodplains. Larger streams are characterized by wider floodplains that conjoin the colluvial toe slopes along their distal margins. Evidence of lateral accretion, meandering, and channel avulsion was also observed along the trunk streams.

Local Stratigraphy and Depositional Chronology

Conclusions regarding the stratigraphy of segments of the project area are based on observations in eight backhoe trenches (BHTs) at site 41WB441 (southern end), seven BHTs at site 41WB578, and existing natural exposures at sites 41WB572, 41WB621, 41WB622, and 41WB624 (southern end) (Figure 2.5). In general, the stratigraphy of deposits at these sites corresponds to the mapped soil series, but local differences are common. Gypsum is present in many of the profiles, but only the Maverick series (Ustollic Camborthid) is described as gypsic. In most of the upland soil profiles, siliceous gravels are more abundant than in typical examples of the nominal series. BHTs excavated on the floodplain of San Idelfonso Creek revealed soils (sandy to clayey overbank and channel-margin deposits) that are much thicker, more complex, somewhat better developed, and probably moister than the mapped soil type, a Torriorthent (no series defined). Buried soils were also encountered in some of the trench profiles and natural exposures.

Overall, the profiles indicate net denudation to local deposition in the highest parts of the landscape, limited to moderate accretion on slopes (increasing downslope), and significant continual floodplain deposition, with evidence of lateral migration of channels. Fine-grained sediment has accumulated as slope wash on the convex slopes and as overbank deposits on floodplains. The chronology of the deposits is poorly defined, although clear associations with prehistoric cultural features may indicate middle to late Holocene age. A veneer of Historic to modern slope wash on both the concave and convex slopes may post-date initial brush clearing.

Geomorphological Effects on the

Figure 2.5. Chris Caran conducting geomorphological assessment of a backhoe trench of site 41WB441.

Archaeological Record

Cultural resource potential varies across the landscape and from site to site. A detailed model of the effects of erosion and deposition in the area is presented in Figures 2.6–2.9, and a brief account is provided here since it is integral to the subsequent discussions of sites and their interpretations.

Bedrock exposures and intact Rio Grande terrace remnants may afford surficial features and artifact scatters, and undoubtedly served as lithic procurement areas. Mechanisms of sedimentation in these terrains are, however, restricted, and site burial should not be expected in most of site 41WB621 and parts of site 41WB572. Nonetheless, localized deposition can occur in these settings, and buried features were, in fact, observed in the walls of gullies within the topographic saddle separating the northern and southern halves of site 41WB572. Erosion and non-deposition do limit the variety of features that can be preserved in the uplands and may adversely affect temporal discrimination among superimposed cultural remains; yet even sites on exposed bedrock can yield useful cultural data. For example, the relative positions of coarse lithic materials at these sites may have been virtually unaffected by prolonged exposure to the elements. Coarse, dense particles are difficult to transport by the geomorphic processes operating on low-relief upland surfaces. Therefore, the features and objects found there may retain their original anthropogenic relevance.

Other upland sites were areas of early and continuous site burial. At site 41WB441, slope-wash deposits blanket the slopes and thicken northward toward the stream. In fact, BHTs 7 and 8 appear to have been excavated along the distal margin of the floodplain or on a low flood terrace. Vegetative cover may have been disturbed by fire and other human activities during the period of site occupation, which would help to account for contemporary sedimentation and burial at the highest elevations. Eolian deposition may have been a minor contributing factor, but is unlikely to have been rapid enough to have preserved the buried feature discovered during the present investigation. Sites 41WB622 and 41WB621 were also areas of penecontemporary deposition (probably ≤ 1–1.5 m thicknesses) along their respective low-order tributary channels. There is evidence of significant recent brush clearing, which probably destroyed some features. Lag-gravel deposits at these sites may have helped to stabilize the lower slopes and inhibited gullying, thereby preventing further

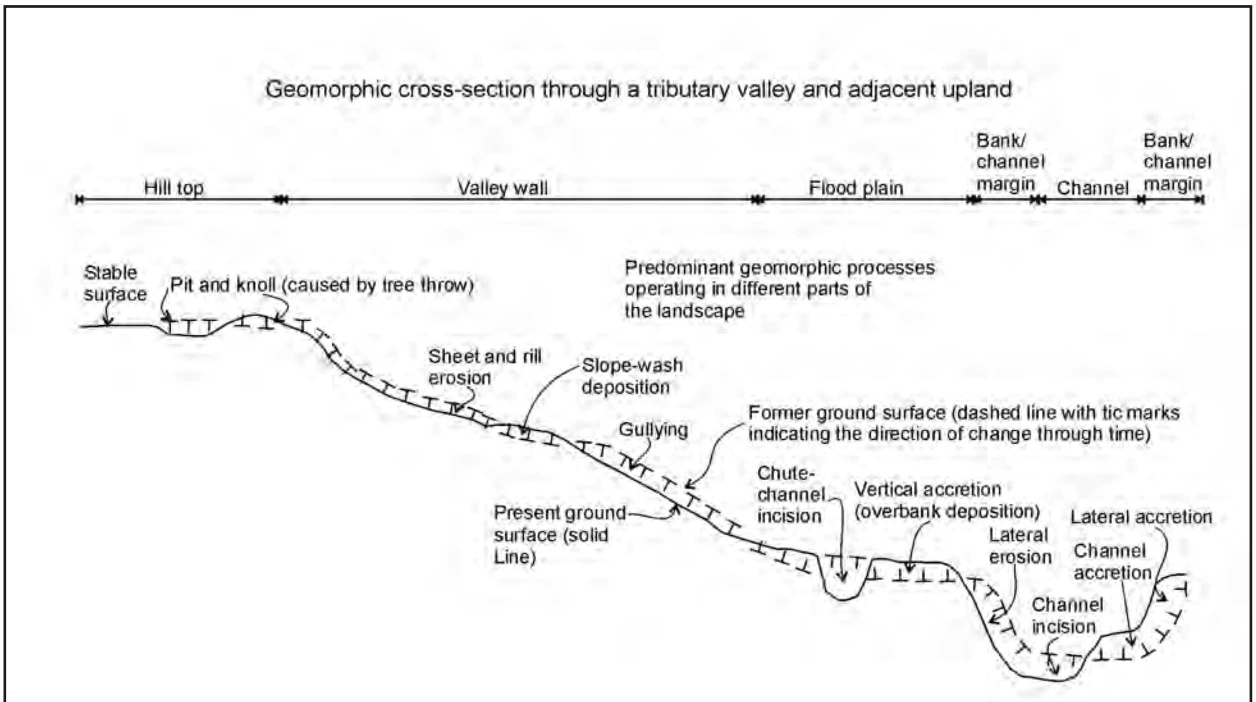


Figure 2.6. Geomorphic cross-section through a tributary valley and adjacent upland.

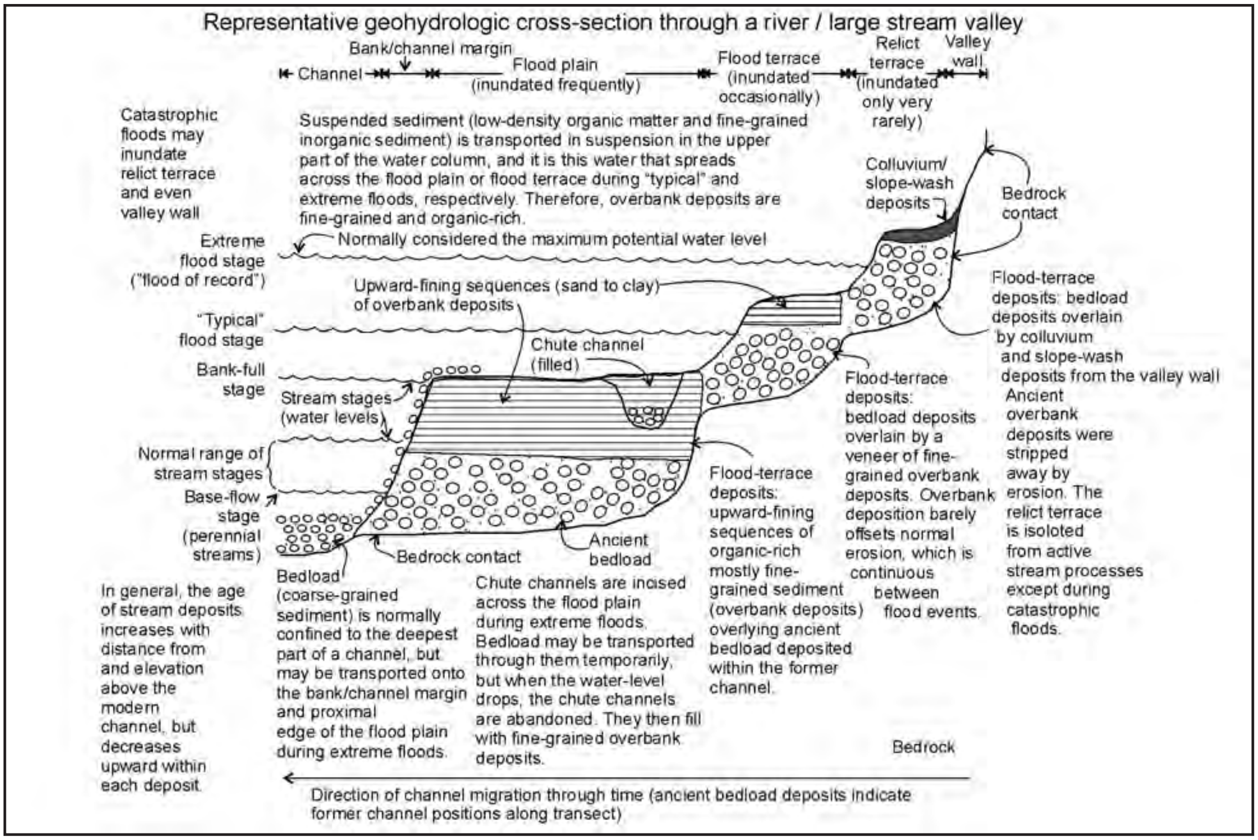


Figure 2.7. Representative geohydrologic cross-section through a river/large stream valley.

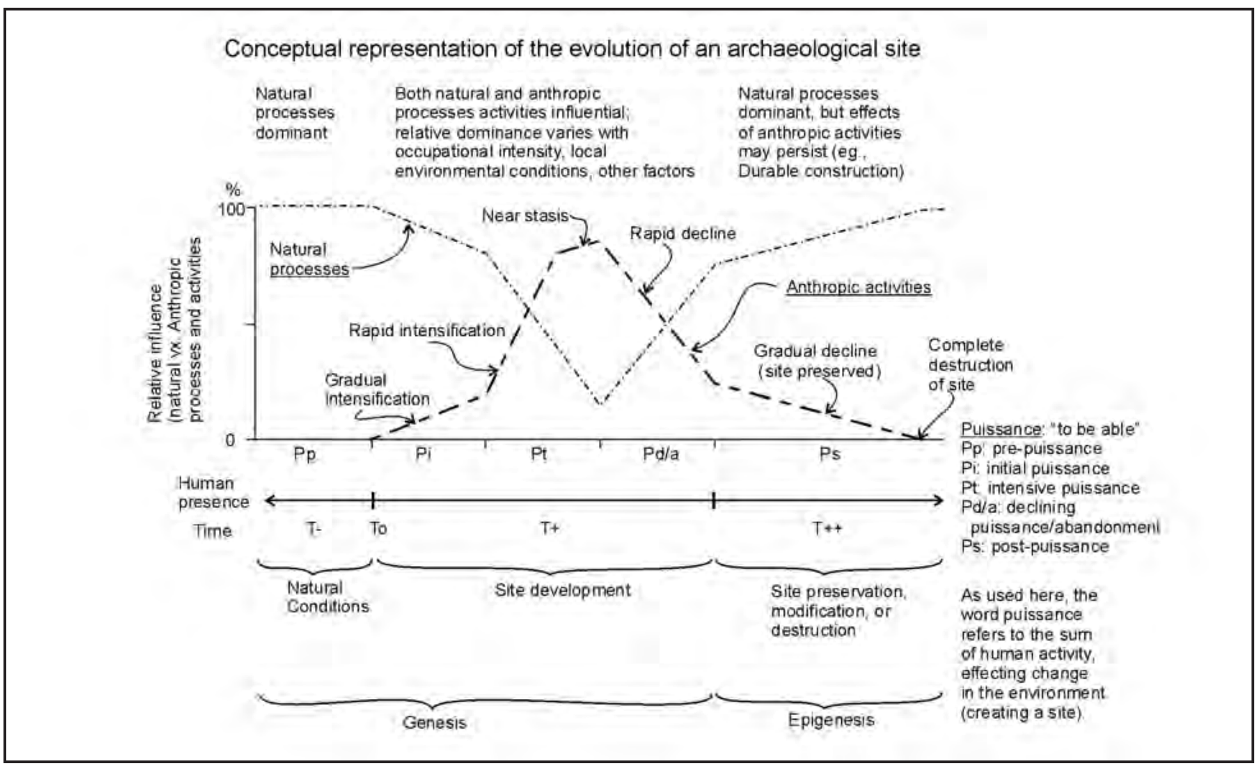


Figure 2.8. Conceptual representation of the evolution of an archaeological site.

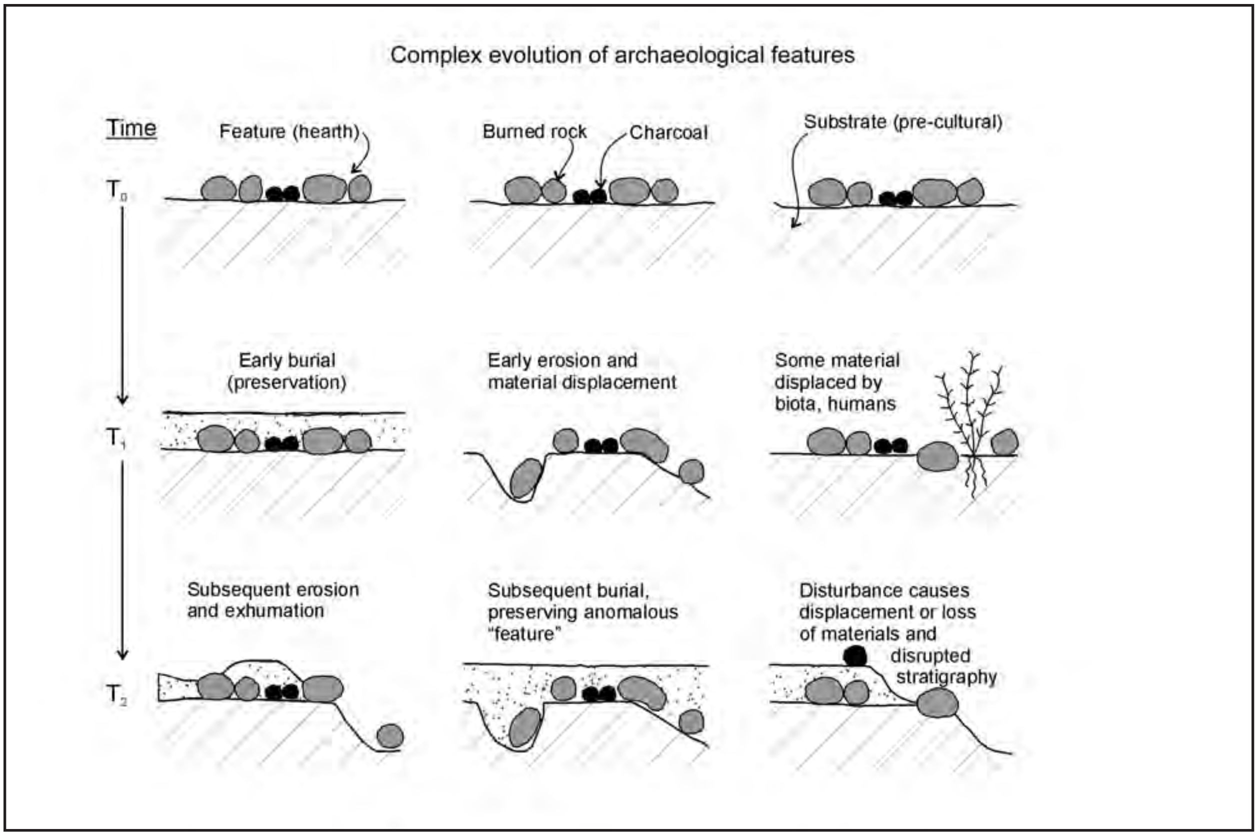


Figure 2.9. Complex evolution of archaeological features.

disruption of site integrity. Although located in a similar geomorphic setting, site 41WM621 does not appear to have received appreciable deposition, and was more heavily disturbed by brush clearing than were the previous sites.

At site 41WB578, subsurface site preservation is demonstrated in at least two geomorphic contexts. Slope-wash deposits interfinger with overbank sediment along the toe of the slope, where a burned rock feature was discovered at a depth of less than 40 cm, immediately above the bedrock contact. This part of the site is approximately 1 m above the floodplain, and overbank sedimentation at this elevation was probably infrequent. Another burned-rock feature was found at a depth of 140 cm in the floodplain, where overbank sedimentation was greatest. An abundance of well preserved charcoal attests to the effects of rapid burial and the relatively stable conditions at moderate depths. Most of the surviving charcoal and organic staining was, however, confined to the soil immediately beneath the largest hearthstones. This indicates that the water table often remained below the depth of the feature, allowing vertical infiltration of rainwater, which carried away the organic materials not capped by stones. Sediment collected from beneath the stones may retain charcoal and other carbonaceous materials from both fuel and food items.

Archaeological and Cultural Context

South Texas, as an archaeological region, is an arbitrary subdivision of the larger South Texas-Northeastern Mexico archaeological area, merging with several other culture regions, including Central Texas, the Central Coastal Bend, and Lower Pecos. Although the South Texas region has often been defined as including the portions of these adjacent areas, most prominently the Coastal Bend, many see these other areas as having distinct cultural trajectories (Hester 1995; Ricklis 1995).

Cuatro Vientos is situated in the Lower Rio Grande Plains, a subdivision of the South Texas archaeological area. As many authors have noted, different areas within the region have very distinctive cultural histories, such as among the coastal groups, those in the interior savannah, or along the Rio Grande valley. Webb County is considered southernmost or "extreme" south Texas, and a number of authors have presented overviews of its cultural chronology (Suhm et al. 1954; Mallouf et al. 1977; Hester 1980; Black 1989). Since the earliest work, there seems to be a common opinion that the area is lacking data from well-excavated sites. Since these writings, several publications in the last 10 years or so have filled in a few gaps (Mahoney et al. 2002; Miller et al. 2000; Quigg et al. 2000; Quigg et al. 2002).

The following portions of this chapter will briefly describe the data from Webb County, a few salient investigations conducted in the area, and a brief review of the culture history. Since the temporal components identified in the Cuatro Vientos site include only the last 4,400 years or so of the cultural chronology, the discussion will be limited to that timeframe.

Data sources

Part of the Cuatro Vientos project entailed the compilation of archaeological data from the area as part of the initial efforts to develop a historic context. The intent was to determine how much information was available and its utility in developing the context. The background data collection focused on compiling four basic bodies of information: 1) a thorough list of all pertinent references that yield information on the sites with the culturo-temporal components of concern within the geographic area; 2) all sites within the area for which "good" data (i.e., specific quantification and qualification) on features, artifacts, and setting is available; 3) feature data from these sites; and 4) artifact data from the well-documented sites.

Data were compiled from reports and files housed at the Texas Historical Commission (THC) and the Texas Archeological Research Laboratory (TARL), the libraries at the University of Texas at Austin, as well as from the THC Atlas on-line database. The main objective was to gather as much information as possible but rely primarily on the published literature, typically considered the most reliable and verifiable. The literature was sorted by type of investigation: survey, survey and testing, testing, data recovery, and analysis. Only data from testing and data recovery was filtered out and arranged in tables containing feature data and associated artifacts. Feature types consist of hearths, burned rock scatters, burned rock clusters, discarded hearth material, and mussel shell middens. Associated artifacts consist of temporal diagnostics, formal tools, and informal tools.

The review identified 86 reports and publications from survey, testing, and data recovery investigations in Webb County. Of these 86 reports, 48 were results of pedestrian surveys, 27 were results from sub-surface testing, four were from data recovery investigations, and the remaining seven were analytical publications. A total of 25 sites in the literature were tested and/or mitigated, and within these sites, 183 features and 195 artifacts were documented (Appendix F).

Previous Investigations

A variety of different types of investigations have been conducted in and near Webb County, including broad syntheses, settlement pattern studies, geoarchaeological assessments, and the varying levels of archaeological study as listed above. The following sections provide an overview of a number of salient studies.

Settlement Patterns

A number of settlement or mobility pattern models have been proposed to explain and predict the archaeological cultures and site distributions of the region. These include a "base-satellite" or savanna adaptation model by Hester (1976, 1981), a model based on the utilization of both ephemeral and perennial water resources by Shafer and Baxter (1975), and a linear site model by Lynn et al. (1977). In addition, Campbell and Campbell (1981) have provided archaeologists with an ethnohistorical model. Among the many considerations these models address are 1) a functional classification of sites and 2) site distribution in relation to the larger landscape. Within each of these two considerations are numerous ancillary issues (such as paloenvironmental and landscape reconstruction, site structure, subsistence patterns, contemporaneity, etc.) that must be addressed in order to assign site function and position in relation to resources. Although the models have at times been mistakenly viewed as either mutually exclusive or regionally applicable, it should be noted as a general caveat that each was developed to interpret specific data bases.

While the region was once commonly viewed as rather homogenous in terms of both culture history and ecology, Hester (1981) stressed the microenvironmental diversity and consequent variations in cultural adaptation. His model recognizes "high density resource areas" and "low density resource areas" as microenvironments of differing extractive potential. The "savanna adaptation", which applies to the prehistoric inhabitants in the interior region of South Texas, identifies an adaptive pattern that relies on the different potentials of the riparian and grassland zones. Low density resource areas, the upland grasslands, would necessitate higher mobility and consequently be represented by a broader and more varied distribution of archaeological sites. High density resource areas such as the riparian zones "may have permitted less mobility, a seasonal cycle of exploitation, and reuse of preferred campsites situated in locales of varied and abundant resources" (Hester 1981:122).

Shafer and Baxter's model (1975), derived from archaeological investigations in Atascosa County, was an attempt to test the model initially proposed by Hester (1971) for sites in Zavala County. Hester found that base camps tended to cluster along riparian flood plains, while site types representing the specialized activities of small hunting and foraging parties were located in the upland and upland terrace areas. To test whether these patterns were also applicable to the Atascosa setting, Shafer and Baxter (1975) developed a classificatory scheme based on artifact content and topographical zones. In accordance with Hester's findings, they hypothesized that base camps, or multifunctional sites as defined by the number of activities represented in the artifact assemblage, would predominantly be found in the lowland riparian areas. Conversely, sites representing a limited array of activities, such as lithic resource procurement, would generally be found in upland divide and upland margin zones. However, Shafer and Baxter (1975) concluded that the various site types were distributed throughout the range of arbitrarily defined topographical zones and not clearly patterned as their hypothesis predicted. The observed distribution was interpreted to indicate an adaptive strategy that relied on the utilization of both perennially available as well as seasonally or periodically available resources in both uplands and riparian areas. This conclusion effectively undermines the notion of spatial patterning of the various site types since base camps and limited function sites are present in all zones.

Robinson (1995) offered substantive revisions or critiques of the Shafer and Baxter model based on additional work in Atascosa County which included some areas that contributed to their original formulation. First, the physiographic zones are not sufficiently distinct nor separated widely enough to imply different extractive strategies. All zones are basically the same upland resource zone. Secondly, the site typology is too broad to accommodate the variability seen within functional categories. Finally, Robinson (1995) suggests the model attempts to explain one segment of the overall mobility pattern, what was presumably a seasonal round without reference to the other portions of the yearly activities.

The model proposed by Lynn, Fox, and O'Malley (1977) is an interpretation of extensive, undifferentiated scatters of occupational material along creek terraces in the Choke Canyon area. The authors suggest the inhabitants returned on a cyclical, perhaps seasonal, basis to the same spots. This pattern eventually created an archaeological record described as "linear sites" composed of multiple overlapping occupational remnants along riparian corridors.

The ethnohistorical study by Campbell and Campell (1981:13) substantiates portions of the models mentioned above, particularly Hester's (1981) general savanna adaptation model, and adds another possible site type. Reports of the Mariames, a Coahuiltecan group, indicate a wide ranging mobility pattern based on seasonally available resources. Short-term gatherings of multiple bands were held on an annual basis, often in the summer for the South Texas groups when the prickly pear fruit ripened. The mitotes, as these aggregations were called, could possibly be identified in the archaeological record.

In general, these models offer a starting point for comparison and further refinement of the different regional and chronological subdivisions. These models identify a basic functional site typology that includes base camps and short-term camps. Base camps are distinguished by evidence of numerous activities and a relatively longer duration of stay. Short-term camps are utilized by smaller groups for a shorter duration and are identified by an assemblage indicating a more limited number of activities. These short term camps are often from extraction activities. Additionally, different ecological zones are identified: lowland riparian zones of concentrated resources and upland areas with dispersed low density resources. While base camps are usually found in the riparian zones and short term camps in the uplands, Shafer and Baxter's (1975) findings show there is significant variation in this pattern because the resource structure can vary temporally and geographically. As Robinson (1995) points out, however, one of the problems in comparing different areas is the ambiguities of terminology. For example, the functional classes of sites, topographical subdivisions of the landscape, or extractive potentials may be difficult to correlate between databases. These observations, interpretations, and caveats will be used in the assessment of the Cuatro Vientos project area sites later in this report.

Regional Geomorphological Studies

Only recently has geomorphological study become an integral part of archaeological investigation in the Webb County area. Beginning with Collins' work on several sites tested by Warren (1992a) in the Rachel Mine Permit Area, a series of studies have begun to produce a cross-sectional picture of the three main depositional settings in the area: the Rio Grande terraces, upland creek terraces, and uplands. A brief report of these findings is given here, followed by a summation to point out pervasive trends, some of which are also identified in the Cuatro Vientos study area.

Geoarchaeological investigations were conducted as part of the archaeological work conducted in the Camino Colombia Project in 1998-99 in Webb County, Texas (Miller et al. 2000). Examining 15 sites over a 22-mile long transect across uplands, low-order tributaries, and high order creek valleys just north of Laredo, the study by Nordt was focused on reconstructing the late Quaternary landscape and assessing archaeological preservation potential in various settings. Thirty backhoe trenches, numerous cutbank exposures, and several test unit profiles were utilized in the study. The results of this study included several conclusions that are relevant to the Cuatro Vientos study. These include: 1) upland soils, including those in most low order upland valleys and high fluvial terraces, are at least Pleistocene in age and have very low potential for prehistoric site preservation in buried contexts; 2) the bulk of high order stream valleys are filled with early to middle Holocene alluvium that may contain buried Early Archaic, Middle Archaic, Late Archaic, and Late Prehistoric sites; 3) a palimpsest of sites dating to most of the prehistory of Texas will be preserved on Pleistocene upland and terrace deposits; 4) a veneer of historic sediment buries most parts of the upland, terrace, and floodplain landscape to depths of between a few cm and 40 cm (Miller et al. 2000:31-32).

Collins (1992) studied a number of sites and localities in northwestern Webb County. Site 41WB136, situated in the Rachel Mining Permit Area on the upland margin overlooking the Rio Grande Valley, contained several weakly expressed buried A horizons at depths of 50–70, 100, and 120–150 cm below surface. These "upland valley" Pinto Creek terrace soils yielded radiocarbon dates of 2480, 4050, 4340 B.P., respectively (Collins 1992:63). Thin eolian deposits were identified across portions of the project area and are interpreted as being of recent origin. Although the dates suggest the potential for buried deposits, none were identified in the limited investigations.

Ed Garner (McGraw and Thompson 1998) conducted geoarchaeological investigations on site 41WB206 in the area of the Laredo-Columbia Solidarity International Bridge. Situated on the Rio Grande terraces, four terraces were defined in the study area. Terraces T1 and T2 showed recent alluvium indicating active aggradation. The T3 (Darwin) and T4 (Dolores) terraces contained buried cultural materials and yielded a number of radiocarbon dates. The T3 terrace contained buried cultural materials dating from 5300 to 2300 years ago, deposited before the landform stabilized around 2000 B.P. An overlying stratum yielded humate dates of 1550 and 500 B.P. Four radiocarbon assays from the Dolores (T4) terrace yielded dates of 2250 B.P., 3100 B.P.., 4250 B.P., and 5350 B.P. (McGraw and Thompson 1998:40). Overlying this T4 terrace is a thin mantle of soil interpreted as being analogous to an overlying stratum on the T3 terrace, suggesting the final episode of deposition occurred in the last 2000 years. Late Pleistocene and Early Holocene deposits were not identified in the investigations; they are missing from the T3 terrace but are possibly present in a deeply buried context in the T4 terrace.

Nordt's (1998) study of 41MV120, although located roughly 100 miles north northwest of the study area, is one of the more extensive geomorphological studies in the Rio Grande Plain. Located on the northern terrace of Elm Creek one mile upstream from its confluence with the Rio Grande, the depositional sequence mirrors many of those identified in Webb County. Consequently, some of the interpretations are perhaps applicable to the study area. Nordt (1998) identifies three terraces. The T2 terrace dates from roughly 10,000 to 12,000 B.P.; the T1 terrace aggraded through the early Holocene until about 4000 years ago; the T0 terrace, a modern floodplain, is less than 4000 years old, possibly as recent as 1000 years. Within the Holocene T1 and T0 terraces, three stratigraphic units were defined, Units 1, 2, and 3 from oldest to youngest. A humate sample from Unit 1 yielded a date of 6010 B.P. indicating the later stages of deposition for this unit. Unit 2 began aggradation sometime thereafter, continuing until approximately 1200 B.P. (Nordt 1998). Prior to deposition of Unit 3, a period of downcutting occurred between 1100 and 1300 B.P. Subsequently, aggradation resumed by about 1100 B.P. and continued to the present. Based on density of artifacts in relation to rate of deposition, peak cultural activity occurred at slightly different times in different areas of the site but generally took place between 2500 and 1500 B.P. Based on stable carbon isotope ratios comprising the soil biomass, a general paleoenvironmental reconstruction was proposed for the site area. The following conclusions were drawn: 1) the early Holocene was cool with a relatively low abundance of grasses, 2) between 7500 and 4000 B.P. grasses increased, as did temperatures, 3) grasses decreased and temperatures cooled after 4000 B.P., and 4) there were possibly short duration warming intervals between 2200 and 1200 B.P.

Maslyk et al. (1996) studied the depositional setting of three sites on Chacon Creek located on the southern periphery of Laredo, south of Lake Casa Blanca. Both Rio Grande and Chacon Creek terraces were investigated through backhoe trench and test unit exposures. While the Rio Grande terraces revealed no buried soils or cultural materials, two or more buried soils were identified in the Chacon Creek terraces. Despite radiocarbon dates and diagnostic artifacts, precise dating of the soils could not be ascertained because of various ambiguities. On site 41WB9, a shallowly buried soil yielded a radiocarbon assay of 780 B.P., while a sample of bulk sediments taken from the underlying C horizon dated to 6600 B.P. The wide disparity in ages led the authors to suggest an older age for the buried soil as the 780 B.P. was possibly skewed by recent organics moving downward. Overall, the dating of the soils was inconclusive.

Abbott's (1997) study of sites 41WB437 and 41WB438 along the San Idelfonzo Creek drainage identified two stratigraphic units: a lower Unit 1 and upper Unit 2. Unit 1 is probably Late Pleistocene while Unit 2 aggraded between 4000–5000 B.P. to 1500–2000 B.P. The upper surface of Unit 1 was "truncated by surface scour, then buried by renewed aggradation" (Abbott 1997:18). Three radiocarbon dates from charcoal associated with buried hearths included two dates of circa 2100 B.P. and one of about 3250 B.P. (Abbot 1997:20).

Gustavson and Collins (1998) also studied the San Idelfonzo Creek drainage as part of a larger study that investigated the terraces of the Rio Grande from the Gulf of Mexico to Amistad Dam. Unfortunately, the geomorphic units designated by Gustavson and Collins (1998) do not directly correlate with those described by Abbott (1997). Additional geomorphic studies, conducted concurrently with the mitigation of 41WB437, in the same locale offer a third model for the same drainage (Quigget al. 2000). The latter study identified five zones that Quigg et al. (2000) relates to the stratigraphy identified by the other studies.

Quigg and Cordova (1997:19–21) define three major depositional units in the alluvial setting of an upland tributary along the line based on TRC Mariah's 1997 Webb County survey. The T0 terrace, comprised of Unit A, is defined as the modern floodplain containing sandy deposits and gravel lenses. Unit B is subdivided into two spatially discrete units including a lower Unit B1, which is a component of the T1-1 terrace, and an upper Unit B2, part of the

T1-2 terrace. Based on carbonate development, Unit B1 is surmised to date from 1000 to 3000 years and Unit B2 dates from 2000 to 5000 years (Quigg and Cordova 1997:29). The underlying Unit C is an early Holocene pond deposit.

Because the data are still rather limited, no clear patterns can be established from these studies, although one apparent trend is recognized that is particularly relevant to the Cuatro Vientos project. Between roughly 2500 and 2000 B.P. there appears to have been a period of local landform stability indicated by terrace and soil formation. Collins identified a weakly developed soil dating to 2450 B.P. in an upland creek terrace and Garner (1998:44) identified a "mature and stable" T3 terrace tentatively dating to about 2000 B.P. on the Rio Grande terrace. Abbott (1997:20) reports two radiocarbon dates from two hearths on site 41WB437 of about 2100 B.P., dating the latter end of stratigraphic Unit 2. While more data is needed to clarify the setting during this time, cultural and geomorphic indicators are common in many of the area's sites suggesting conditions were conducive to cultural occupation.

Data Recovery Investigations

In 1998, TxDOT contracted TRC Mariah to conduct data recovery excavations at 41WB437, a stratified Archaic site located on a terrace of San Idelfonso Creek west of the Cuatro Vientos study area (Quigg et al. 2000). The excavations documented five to six cultural occupation zones stratified in approximately 120 cm of deposits (Quigg et al. 2000). Radiocarbon dates spanned 3400 to 2000 B.P. (Quigg et al. 2000). Among the numerous burned rock features that were excavated, the predominant diagnostic artifacts were Tortugas points accompanied by other triangular forms including one Matamoros and five Refugio points (Quigg et al. 2000). Three of the upper four occupations were associated with Tortugas and Matamoros points, dating to between 3000 and 2000 B.P. (Quigg et al. 2000).

From 1999 through 2002, studies were conducted on two upland sites located on opposite sides of Beccera Creek near the Rio Grande just west of the project area (Mahoney et al. 2002 and Quigg et al. 2002). Intensive testing followed by extensive data recovery programs were performed by TRC Mariah (Quigg et al. 2002) and the Center for Archaeological Research (CAR), the University of Texas, San Antonio (Mahoney et al. 2002). Exhaustive excavations and a broad suite of sampling and analysis techniques were utilized to explore these two prehistoric campsites, which contained eolian deposits with cultural components spanning the long Archaic period and portions of the Late Prehistoric. These studies resulted in the productive exploration of many important issues, including Tortugas point chronology and technology, burned rock technology and function, occupation and subsistence, and paleoenvironmental reconstruction (Mahoney et al. 2002 and Quigg et al. 2002). The studies did, however run into some of the same obstacles that have faced researchers studying upland sites in the region for years, that is, poor depositional contexts and overprinting.

One of the more relevant studies for the Cuatro Vientos project and one that is most familiar to SWCA is the Camino Colombia Toll Road project (Miller et al. 2000). From 1997–1999, SWCA performed an extensive study of prehistoric sites located along a 20-mile linear corridor extending across uplands from the Rio Grande to Interstate 35 in northern Laredo. The investigations included survey of portions of the road, the design and implementation of a testing plan for 12 prehistoric archaeological sites, and the mitigation of one NRHP significant site. The archaeological study involved a variety of disciplines and analytical techniques, including a broad geomorphological study conducted by Dr. Lee Nordt. SWCA tested 12 of the 51 prehistoric sites identified along the 400-foot wide roadway. These sites are similar in content to Cuatro Vientos, with only variations in size and numbers of features/artifacts. Most were campsites situated on upland tributaries, lithic procurement areas, or combinations of both. Many were very large in size and boundaries were difficult to delineate as features and sparsely scattered artifacts were found over the entire landscape. The sites were in various states of preservation (usually poor), composed of eroding burned rock features of sandstone and siliceous gravels with abundant lithic tools and debitage. Utilizing criteria of integrity and potential data yield, only one of the 12 sites (41WB314) went to data recovery (Miller et al. 2000).

Few sites on the toll road were found buried in Middle to Late Holocene alluvium. Site 41WB314 was one of these sites, located on terraces of Santa Isabel Creek, a larger upland drainage similar to San Idelfonso Creek in the Cuatro Vientos project area. Data recovery excavations at site 41WB314 focused on further examination of the site's geomorphology, numerous unique cultural features, and, where intact, subsurface deposits. The work was successful in further refining our understanding of the site's depositional environment, and intact, buried burned rock features and cultural components were revealed with hand excavations. Study of the subsurface materials yielded new insights into prehistoric technological organization at the site, mainly regarding cooking and lithic manufacturing technologies. Burned rock features were found to represent multiple processing techniques, including griddle-type cooking hearths and stone boiling. Study of the lithic reduction features resulted in the production of a model of Tortugas manufacturing techniques. In addition, it revealed a heavy dependence on locally available, high-quality lithics for stone tool production. Overall, the Uvalde Gravels found on hilltops around the site appear to have been extensively utilized for the procurement of lithic materials for tools and cooking features. Numerous diagnostic tools were recovered from the site surface, and several radiocarbon dates were processed, further strengthening the site chronology of late Middle through Late Archaic occupation.

Cultural Chronology

The archaeological remains of South Texas provide evidence of at least 11,000 years of cultural occupation. This long chronology is divided into four basic cultural periods: Paleoindian, Archaic, Late Prehistoric, and Historic. The Archaic is further subdivided into several subperiods, including Early, Middle, and Late Archaic. While there is a long and contentious debate over the legitimacy of a "terminal" or "transitional" era at the end of the Archaic, it is included in this cultural chronology for purposes that will be defined throughout the course of this report. In addition to these basic divisions, there are a "plague" of phases, foci, complexes, traditions, and horizons, some of which are fairly clearly defined while others remain ambiguous or have become obsolete. For the purposes at hand, these are all subsumed within the chronology presented here.

The chronology of the Lower Rio Grande Plains generally follows regional norms utilized over the last half century, though this chronology varies among researchers and is marked by incompatibility among regions. What is called Middle Archaic in south Texas is almost entirely within the Late Archaic in central Texas. A review of the designations on the site forms indicates the mainstream designations generally follow Hester's (1980, 1995, 2004) chronology for the greater south Texas region. To maintain a degree of consistency, that trend is continued here, with a few finer distinctions. The older designations, such as the Mier or Falcon Reservoir foci, are largely obsolete. The Brownsville Complex is still apparently a viable construct, though its geographic limits are mainly on the Rio Grande Delta. Late Prehistoric phases, or horizons such as the Toyah are possibly applicable, though these are much better defined elsewhere.

Rather than discuss the entire chronology, only those periods identified in the Cuatro Vientos project area are addressed. The following regional synopsis focuses on only the Archaic through Late Prehistoric times. The dates for each period or subperiod are based on a few of the better dated sites in the study area, though almost all of the sites have their problems. A review of diagnostics artifacts for each period is addressed in a separate section following the cultural chronology.

Archaic Period

Most of the archaeological evidence from this period derives from investigations at Chaparrosa Ranch in Zavala County, Duval County, Choke Canyon in Live Oak and McMullen cunties, Chacon Creek in Zavala and Uvalde Counties, the Falcon Reservoir area in Zapata and Starr counties, and the Laredo area in Webb County. Additionally, numerous isolated studies fill in gaps to present a relatively broad set of data. Much of the recent work has been conducted along the border counties, where increased international commerce has supported numerous infrastructural improvements (i.e., roads, border crossings, and border safety inspection facilities).

Early Archaic (8,800–4,400 B.P.) populations appear to have shifted subsistence practices towards an increased reliance on plant food resources and small game (Black 1989b:49). Early Archaic artifacts found in the region are triangular and stemmed projectile points found throughout South Texas and adjacent areas of northern Mexico. For the Early Archaic Period, Hester (1995) distinguishes between the "Early Corner Notched Horizon" consisting of Martindale-Uvalde-Baker point types and the later "Early Basal Notched Horizon" consisting of Andice and Bell point types. Cultural materials from this period indicate an increased use of stone-lined hearths and the probable exploitation of terrestrial and aquatic food resources. Sites are generally found on high terraces or upland areas. However, as with the Paleoindian Period, Early Archaic sites and materials are generally uncommon in the Rio Grande Plain, and this period of human occupation is presently poorly understood (Black 1989b).

The Middle Archaic Period (4,400–2,300 B.P.) is further divided into early (4,400–3,100 B.P.) and late (3,100–2,300 B.P.) Middle Archaic based on a very distinctive change in artifact styles. The latter part coincides with the presence of Tortugas points and Nueces tools. Sites in the Middle Archaic are much more common than those of earlier periods, and the sites seem to occur in a much broader range of topographic settings. The Middle Archaic is interpreted to have been a period characterized by population increases, an expansion of lithic technologies, and more intensive utilization of plant food resources. Larger, compacted hearths and ground stone tools are believed to indicate increased utilization of plant foods (Black 1989b). Dart points, unifacial scrapers, and preforms found at Middle Archaic sites suggest hunting and manufacturing activities. Gouges are present in artifact assemblages in increased numbers over the preceding period, possibly suggesting increased wood- or hide-working activities (Hester 1995). The appearance of projectile point types typical of other regions and marine shell originating from outside the area suggest an expansion of trade/exchange networks in the region. Burial of the dead in cemeteries appears to be more common in this period as evidenced by excavations at the Loma Sandia site in Live Oak County (Taylor and Highley 1995). Dart points from this period consist of Tortugas, Abasolo, Carrizo, Pedernales, Langtry, and Bulverde types. However, as discussed below, the unstemmed points are fairly ambiguous chronological markers.

The Late Archaic and Transitional Archaic Periods (2,300–1,200 B.P.) are often cited as representing a continuation of trends begun in the Middle Archaic, mainly increasing population and intensive exploitation of the environment, though this assumption will be tested in this report. Late Archaic sites are common throughout South Texas in all topographic settings. The presence of large cemeteries along the coast and eastern portions of South Texas suggest increased population densities for this period (Black 1989b). As with the preceding period, populations in the Late Archaic exploited plant food resources, small game, and aquatic resources. Unstemmed dart points of the Matamoros and Catan types have commonly been considered diagnostic artifacts of the Late Archaic, although a number of studies (e.g., Mahoney et al. 2002; Shiner 1983) have questioned the integrity of the types. Other point types from this period commonly found in the region include Shumla, which are somewhat better defined based on studies in the Lower Pecos area.

Late Prehistoric Period

The Late Prehistoric (1,200–250 B.P.) is marked by two technological innovations, ceramics and the bow and arrow. Prehistoric sites from this period are often the best preserved, most distinctive, and visible of all periods in South Texas. Ceramics dating to this period are generally bone and/or sand tempered. Late Prehistoric settlement patterns suggest increased mobility, perhaps an effect of greater reliance on bison as a subsistence mainstay. Faunal assemblages dating to the Late Prehistoric show an increased consumption of bison, deer, and antelope (Black 1989b). At the Hinijosa Site in Jim Wells County, the well-preserved faunal remains associated with a Toyah occupation showed a dependence on deer and antelope, and to a lesser extent, bison (Black 1986). Adoption and use of the bow and arrow may have facilitated the shift in balance between animal and plant foods. In South Texas, common arrow point types include Perdiz, Scallorn, Fresno, Starr, and Zavala. The social and material culture of the period can be inferred to some degree by the ethnohistorical record, as discussed below.

Ethnohistorical Indigenous Groups

The Spanish chroniclers of these expeditions and early missionaries provide ethnohistorical descriptions of the native groups in South Texas at the time of contact. Their accounts defined the groups in northeast Mexico as "Coahuileños". From the recorded fragments of the language of these groups, Mexican linguists defined the Coahuilteco language in the 1860s, and later researchers constructed the larger Coahuiltecan linguistic family, which was surmised to include the language of groups throughout the northeast Mexico-South Texas region. Although some (i.e., Ruecking 1953, 1955a, 1955b; Newcomb 1961) have proposed a broad Coahuiltecan culture as well as a linguistic grouping, "this belief in a widespread linguistic and cultural uniformity was [later] seriously questioned" (Campbell 1983:343). Recent research has perhaps substantiated this notion. For example Johnson and Campbell (1991) defined the previously unidentified Sanan language among mission Indians in the region. In part there was perhaps a rush to judgment in defining a "monolithic adaptation" that led to an oversight in variability.

Nevertheless, the ethohistorical record suggests some commonalities among the groups in the region. All were nomadic hunter/gatherers who moved around the landscape exploiting seasonal foods (Campbell and Campbell 1981), most likely within clearly defined territories. Griffen (1969:115) cites a number of early descriptions of highly mobile groups moving within clearly recognized and "marked" areas. Alonso de Leon, who was observing groups south of the Rio Grande in 1689, describes the social organization and settlement patterns that were commonly noted elsewhere in the region. He describes two distinct groupings using terms familiar to his own society: the "rancheria" and "rancho". The former group is a larger group, presumably the band. Based on ethnographic accounts of groups in northeastern Mexico, Griffen (1969:115) infers an average band size of 40–60 persons with recorded variations ranging from roughly 25–75 individuals. These rancherias often comprised about 15 bell-shaped huts arranged in rows or a crescent formation. Each house contained a central fire said to be used mainly for illumination (Campbell 1983:51). As described by De Leon, the smaller group, occupying the rancho, was a family unit. When not in the larger groupings "each family …or two together travel around the hills, living two days here and four there" (De Leon as cited by Griffen 1969:115). In addition to these groupings, sources often refer to a larger group, a "nation". This group is the largest identity, but it is unclear if this level of tribal organization was ever a viable political entity until later ethnohistorical times when regional groups united to confront colonial advancement and decimation. From the early seventeenth century to the nineteenth century, increased pressures from southward territorial expansion by the Apache and Comanches and northward Spanish expansion destroyed these indigenous groups.

Flaws, Gaps, and Biases in the Data

The culture history, based on a long history of previous investigations, shows a rather comprehensive view of the area's prehistory. However, there are quite a few flaws, gaps, and biases in the data that have been pointed out for a long time. These issues are important in the critical evaluation of the prevailing understanding of the archaeology. Of the many problems, some are intrinsic to the record, and some reflect artificial biases. Intrinsic biases include aspects such as long erosional periods that simply removed portions of the regional archaeological record. Artificial biases include factors such as the fact that archaeological projects tend to be conducted in the vicinity of population centers such as Laredo. That is where the development is and where the cultural resource laws dictate compliance. Therefore a disproportionate number of sites are recorded in these areas.

There are many problems along these lines, and if considered in detail, it would be rather overwhelming and likely lead to the conclusion that nothing can be said with any certainty. Nevertheless, it is necessary to present the data and interpret, fully understanding it will not be the final word. Ideally, in time the biases will be addressed through rigorous testing of hypotheses. To say nothing because of the problems is not an option. Sites are being destroyed at an ever-increasing rate. A context of the prevailing understanding is needed for the most basic management of the resources. A few of the better documented problems are briefly discussed here to qualify the problems.

Cultural Index Fossils – the Fine and Flawed art of Discerning Diagnostic artifacts

Over the last half century or more, there have been long and effective (generally speaking) efforts at classifying artifact styles and discerning their temporal and spatial distributions throughout the study area. Once the formal, spatial, and temporal patterns are recognized, certain artifact styles can be tied to larger archaeological assemblages and cultures, thereby serving as cultural index fossils, or so-called diagnostic artifacts. In South Texas, where forces have so often washed away materials (such as organic remains) for absolute dating, diagnostic artifacts are quite often the only means of determining cultural or temporal affiliations of archaeological sites. Consequently, in comparing the Cuatro Vientos data to the wider archaeological context, this report relies heavily on artifact types in reckoning spatio-temporal patterns.

The Cuatro Vientos sites provided very little direct dating of artifacts – no evidence to directly challenge, refute, or confirm the regional chronology. Chronological resolution is not the strength of these sites. While it is far beyond the scope of this report to reconstruct the many problems and discrepancies in the regional chronology, the effort here is to specify the individual sources that constitute the basis for temporal affiliations of artifact styles or types used in the analysis of Cuatro Vientos data. Table 2.1 lists the primary sources for the temporal affiliations of various artifact styles identified on site forms from Webb County.

A few general observations on the artifact chronology are warranted here. First, as noted, the South Texas record is often plagued by the lack of chronological precision, and consequently, many of the types cited in Table 2.1 rely on better-dated proveniences and chronologies beyond South Texas, primarily in the Lower Pecos or Central Texas. One potential problem in using chronological data from adjacent areas is the possible lack of precise temporal correlations among the regions. A projectile point type such as Langtry may have had quite a long temporal span in the Lower Pecos, but only spread into south Texas when conditions were conducive to such movement. However, there have been few cases where directional spatio-temporal change been clearly identified in south Texas projectile point styles.

Second, some commonly recognized types, like Refugio or Lerma points, are so vaguely defined chronologically that they are not included in the list of temporally diagnostic artifacts. Turner and Hester (1999), for example, simply define Refugio points as “Archaic”, a designation that lacks sufficient resolution for most of the purposes in the Cuatro Vientos analyses. Of note, the following chronology is represented in Before Present time scale (B.P.) with referenced dates maintaining their original time scale (B.C./ A.D. or B.P.). However, a general B.P. date is provided from the widely accepted 1950 date.

For the early part of the Middle Archaic (4,400 to 3,100 B.P.), Pedernales, Langtry, Bulverde, and Kinney points are considered diagnostic artifact types. In Central Texas and the Lower Pecos regions, these points are chronologically better defined than in much of south Texas. Johnson and Goode’s (1994:29) review of the Edwards Plateau chronological data places the advent of Bulverde points at 2300 B.C. (4,250 B.P.), with Pedernales points emerging from the former style a short time thereafter. Goode’s (2002) analysis of Kinney points indicates their techno-morphological traits, stratigraphic co-occurrence, and geographic distribution indicate a close relationship with Pedernales points. Langtry points are best defined, chronologically and otherwise, in the Lower Pecos region where they are affiliated with the San Felipe Subperiod dating from 4,100 to 3,200 B.P. (Turpin 2004:270). One additional diagnostic artifact of the period is perhaps the Clear Fork tool. These are typically assigned to a broad timeframe, but based on the Choke Canyon Reservoir data, Hall et al (1986:399–400) suggest they have a more distinctive temporal range from 2350 B.C. to 695 B.C. (4,300 to 2,645 B.P.), which coincides with the Middle Archaic, primarily the early part of the period.

For the late Middle Archaic (3,100 to 2,300 B.P), Tortugas and Abasolo points are perhaps the most ubiquitous artifact types, with Lange, Morhiss, and Carrizo points being somewhat less common. Tortugas points have been subject to quite a bit of scrutiny as a temporally and typologically distinct form. Quigg, et al. (2000) show Tortugas points

Table 2.1. Diagnostic Artifacts from the Lower Rio Grande Plains

Early Middle Archaic (4400 to 3100 B.P./ 2450 to 1150 B.C.)		Primary References	Comments and additional references
Diagnostic Artifacts	Pedernales	Turner and Hester (1999:171); Johnson and Goode (1994:29)	See specific radiocarbon dates and review of depositional records by Johnson and Goode (1994).
	Langtry	Turpin (2004:270)	Arenosa Shelter (41VV99) - radiocarbon date of 4080 +/- 380 B.P. (Turpin 1991); Hinds Cave (41VV456) - radiocarbon date of 3780 +/- 70 B.P. (Turpin 1991); Fate Bell Shelter (41VV191) - radiocarbon dates of 3330 +/- 110 B.P. (Turpin 1991).
	Bulverde	Johnson and Goode (1994:29)	See specific radiocarbon dates and review of depositional records by Johnson and Goode (1994).
	Clear Fork?	Hester (1995:5)	Clear Fork tools are notoriously difficult to clearly assign to a specific period, but data from Choke Canyon suggests they were prominent in south Texas from 4300 to 2550 B.P. (Hall et al 1986:400).
	Kinney	Johnson and Goode (1994:29)	Based on Goode's (2002) analysis, Kinney are considered technologically related to Pedernales points and therefore temporally identical.
Late Middle Archaic (3100 to 2300 B.P./1150 to 350 B.C.)			
Diagnostic Artifacts	Tortugas	Hester (2004)	At 41LK28 the points are directly dated to 850 to 550 B.C. (Taylor et al. 1995:429). Tortugas points at Cueva de la Zona (in Nuevo Leon - NL92) are dated to 2920 +/- 130 B.P (Turpin 1991:6). At Camino Colombia, A Tortugas point is directly dated to 2740 B.P. (Miller et al 2000:67)
	Abasolo	Hester (2004)	At 41LK28 the points are directly dated to 850 to 550 B.C. (Taylor et al 1995:429).
	Morhiss	Turner and Hester (1999:171)	Based on the Choke Canyon record, Hall et al (1986:398-400) place Morhiss in the Middle Archaic from 2500 B.C. to 400 B.C. However, others chronologies place the style between 1250 and 500 B.C. (Fox 1979:62; Campbell 1976). At 41LK28 the points are directly dated to 850 to 550 B.C. (Taylor et al 1995:429).
	Lange	Collins (2004:113); (Turner and Hester 1999:141)	Prewitt (1981:80-81) places the Lange type between 650 and 350 B.C. At the Loma Sandia site (41LK28), Lange points date from 850 to 550 B.C. (Taylor and Highley 1995:423).
	Carrizo	Poorly dated	At the Loma Sandia site (41LK28), one of the few sites with radiocarbon dates associated with Carrizo points, the type dates from 850 to 550 B.C. (Taylor and Highley 1995:418).
	Nueces?	Turner and Hester (1999:171)	At the Loma Sandia site (41LK28), Nueces tools date to 850 to 550 B.C. and are strongly associated with Tortugas and Abasolo points (Taylor and Highley 1995:470). Choke Canyon site 41LK201 yielded a direct date of 480 B.C. on a Nueces tool (Highley 1986:67).
Late Archaic (2300 to 1850 B.P/350 B.C. to A.D. 100)			
Diagnostic Artifacts	Shumla	Turpin (2004:273)	See Turpin 1991 for review of radiocarbon dates associated with Shumla.
	Marcos	Turner and Hester (1999:147); Johnson and Goode (1994:5); Hester (2004:142); Collins (2004:113)	Turner and Hester (1999) place Marcos points between 600 B.C. and 200 A.D.; Hall et al. (1986:400-401) place the style from 400 B.C. to 900 A.D.; Prewitt (1981) lists them as from 300 B.C. to A.D. 200.
	Montell	Collins (2004:113); Hester (2004:140)	Turner and Hester (1999) date Montell to 1000 B.C. to A.D. 200.
	Ellis	Hester (2004:140); Taylor and Highley (1995:44)	These are poorly dated, particularly the date of their origination. Though Turner and Hester (1999:113) place the type as early as 2000 B.C., Story's (1990:216, 221) chronology for the Gulf Coastal Plain, where the type was originally defined, places Ellis fairly late, just prior to A.D./B.C
	Desmuke	Hester (2004:142)	Desmuke points recovered from Loma Sandia (41LK28) were found above the zone that dated from 850 to 550 B..C. (Taylor and Highley 1995:419)
	Castroville	Collins (2004:113); Turner and Hester (1999:86)	Many chronologies place Castroville slightly earlier than 2300 B.P., the Collins' (2004) central Texas chronology places them within the Late Archaic as temporally defined here.

Table 2.1. Diagnostic Artifacts from the Lower Rio Grande Plains, continued

Early Middle Archaic (4400 to 3100 B.P./ 2450 to 1150 B.C.)		Primary References	Comments and additional references
Transitional Archaic (1850 to 1200 B.P./100 to 750 A.D.)			
Diagnostic Artifacts	Ensor	Collins (2004:113)	Ensors are best dated in central Texas, where chronologies date them to A.D. 200 to A.D. 550 (Collins 2005:113; Prewitt 1981:81; Weir 1976:29)
	Frio	Collins (2004:113)	See Ensors above. Frio are best dated in central Texas, where chronologies date them to A.D. 200 to A.D. 550 (Collins 2005:113; Prewitt 1981:81; Weir 1976:29)
	Matamoros	Hester (2004:143)	There is quite a bit of typological uncertainty in both Matamoros and Catan points, notably in the indistinct and arbitrary division between these and larger forms such as Tortugas. Regardless, smaller forms are typically considered to corelate with later occupations.
	Catan	Hester (2004:143)	There is quite a bit of typological uncertainty in both Matamoros and Catan points, notably in the indistinct and arbitrary division between these and larger forms such as Tortugas. Regardless, smaller forms are typically considered to correlate with later occupations.
	Fairland	Collins (2004:113)	See Ensors above. Fairland are best dated in central Texas, where chronologies date them to A.D. 200 to A.D. 550 (Collins 2005:113; Prewitt 1981:81; Weir 1976:29)
	Edgewood	Turner and Hester (1999:111)	This point is poorly defined typologically and temporally. It is simply described as "Transitional Archaic" by Turner and Hester 1999:111.
Late Prehistoric (1200-250 B.P./750 to 1750 A.D.)			
Diagnostic Artifacts	Starr	Hester (2004:146)	see regional chronologies Johnson and Goode 1994; Turpin 2004; Turpin 1991 for timing of ceramic and bow and arrow advent
	Perdiz	Hester (2004:146)	
	Toyah	Hester (2004:146)	
	Fresno	Turner and Hester (1999:213)	
	All Other Arrowpoints	Hester (2004:143)	
	Ceramics	Hester (2004:143)	

** citations refer to the temporal placement of diagnostic artifacts only, not the cultural period. Two authors may agree on the temporal range of an artifact style, but since cultural periods are defined differently, in terms of absolute dates, among regions, the artifact style can be associated with different cutural periods in different regions.*

as dating from 3,200 to 2,000 B.P., though the best chronological information come from mortuary contexts at Loma Sandia (41LK28) in Live Oak County (Taylor and Highley 1995). Of the 194 Tortugas points recovered from Loma Sandia, 88 percent were recovered from the cemetery zone dating from 850 to 550 B.C. (2,800 to 2,500 B.P.) (Taylor and Highley 1995:433-439). Many points were clearly in mortuary contexts, allowing direct dating. Lange points were also recovered in fairly large quantities from the cemetery zone at Loma Sandia, indicating contemporaneity with Tortugas points (Taylor and Highley 1995:423). This placement is approximately consistent with Prewitt's (1981:80-81) dates of 650 to 300 B.C. (2,600 to 2,250 B.P.) for Lange points.

Regarding Morhiss points, based on the Choke Canyon record, Hall et al (1986:398-400) place this style in the Middle Archaic from 2500 B.C. to 400 B.C. (4,450 to 2,350 B.P.). However, others chronologies place the style between 1250 and 500 B.C. (3,200 to 2,450 B.P.) (Fox 1979:62; Campbell 1976). At 41LK28 the points are directly dated to 850 to 550 B.C. (2,800 to 2,500 B.P.) (Taylor et al 1995:429). According to these latter sources, Morhiss is considered a late Middle Archaic diagnostic artifact.

Nueces tools are defined in this report as diagnostic artifacts for the late Middle Archaic, though work is needed to further clarify the duration of their use. In Choke Canyon (specifically 41LK201), a Nueces tool is directly associated with a radiocarbon date of 480 B.C. (2,430 B.P.) (Highley 1986:67). At Loma Sandia, all eight Nueces tools recovered from the site were dated to 850 to 550 B.C. (2,800 to 2,500 B.P.) (Taylor and Highley 1995:486). Part of the problem with Nueces tools is typological ambiguity, which is briefly discussed in Chapter 5.

The Late Archaic (2,300 to 1,850 B.P.) diagnostics include a suite of broad-bladed points that in some areas have been associated with bison-hunting. These point types include Marcos, Montell, Ellis, and Castroville. Some chronologies place the advent of the styles significantly earlier than 2,300 B.P., but since these tend to be best defined in central Texas, Collins's (2004) chronology is utilized here. Additionally, the narrow-bodied Desmuke is also considered diagnostic of the era. These points were recovered from the stratum younger than the zone dating to 850 to 550 B.C. (2,800 to 2,500 B.P.) at the Loma Sandia site (Taylor and Highley 1995:419).

Transitional Archaic (1,850 to 1,200 B.P.) diagnostics include the common triangular to subtriangular forms Matamoros and Catan, as well as stemmed points Ensor, Frio, Fairland, and Edgewood. Much has been made of the vague and arbitrary division in size between Tortugas and Matamoros points, as well as other similar forms. The study by Mahoney et al. (2002) indicates these are neither viable types nor chronological markers. As discussed more specifically in the following section, distinctions between the Matamoros and Tortugas points and the Abasolo and Catan types cannot be clearly defined, but rather are part of a continuum in size with no discernible temporal distinctions. However, typological overlap has been fully recognized from the beginning (see Suhm, Krieger, and Jelks 1954:448; Suhm and Jelks 1962), but the pattern of smaller triangular points in Brownsville, Mier, and Rockport foci or phase components add credence to the utility of Matamoros as a diagnostic artifact. Clearly, work is needed to provide typological clarification.

Ensor, Frio, Fairland, and Edgewood points are best defined, in chronological terms, in central Texas where most artifact chronologies (Collins 2005:113; Prewitt 1981:81; Weir 1976:29) date these styles from 200 to 550 A.D. (1,750 to 1,400 B.P.), which would put them in the Transitional Archaic as defined herein. Edgewood points are temporally rather vague, but likely fall within this period.

The advent of the Late Prehistoric period, and its distinguishing technologies, is not a discrete boundary, but chronologies often cite a several hundred year period from about 500 to 800 A.D. (1,450 to 1,150 B.P.) for gradual adoption of ceramics and bows in south Texas. By the end of that period, Starr, Perdiz, Toyah, Fresno, a suite of other arrow points, and cermaics are widespread in the archaeological record.

Typological Problems

Clearly, there are problems in the accuracy of diagnostic artifacts, and there always will be. Typology can be a blunt instrument, and so is the process of assigning the types to distinct temporal ranges. Nevertheless, lacking a more thorough body of absolute dates, artifact types constitute the best and often only data that is currently available. Though there are problems, the cumulative efforts over more than half a century provide a reasonably accurate picture of the chronological placement of common diagnostic artifacts in Webb County.

First, the published data was taken at face value – though there is quite a bit of typological uncertainly in many scraper and projectile point forms, if a form says a type, no attempts to verify or second guess the classification were made. For instance, though there may be many typological problems with the differentiation of Matamoros and Tortugas points, if a site form documents a Matamoros point on a site, such data was taken at face value. While various studies have shown potential sources of bias, see for example Mahoney et al. 2002, these have not clearly quantified the biases (e.g., a specific percentage of points identified as Matamoros are actually re-sharpened Tortugas points). Accordingly, while such flaws are recognized, they cannot be "operationalized" in the analysis of a regional database. If as Hall et al. (1982) note and as reiterated in Turner and Hester (1985:122), Tortugas points average 6.7–4.9 mm and Matamoros are 3.2–4.7 mm, there is a fine line separating the two to begin with and there certainly must have been many Tortugas points dipping 2 mm below average length. In most cases, there is no recourse to reassess such classifications as the materials are not documented and were not collected. This is simply the inherent nature of the regional data.

Until the degree of mis-identification can clearly be quantified in a consistent and applicable way, these problems are inherent. Though they must be recognized as a mitigating circumstance, limiting the degree of certainty placed on broad conclusions, typological problems do not rule out the use of projectile points for the purpose of creating testable hypotheses. Minimally, only a few data suggestive of a trend, with a low threshold of certainty, suffice to form a testable hypothesis. By testable, in the vein of Karl Popper's thought, we mean "falsifiable" in that a particular data set can be used to show otherwise.

Second, the database only considers sites for which there are chronological/temporal data. Since diagnostic artifacts, principally projectile points, are overwhelmingly the primary source of such information, it is worth considering whether there is an inherent bias in the nature and distribution of sites with projectile points. Most ethnographic models indicate discard of such formal tools takes place in only a relatively small percentage of the different site types that makeup the totality of hunter-gatherer settlement patterns. This bias is considered on a case-by-case basis in the analysis of the Cuatro Vientos sites.

A third flaw in the data pertains to the way archaeologists have defined "sites". A key aspect in developing a historic context is the definition of property types that can be utilized to address the research theme. The collected data from the area is almost exclusively pertaining to "sites". But, it has been noted (e.g. Ebert 1992, McManamon 1984; Sullivan 1992) that the notion of a site may be useful for management purposes, but has little or no utility for addressing research design questions. Rather than a "site", components, assemblages, features, and artifacts constitute the fundamental data for studying cultural themes. Nevertheless, much of the data that is available is enmeshed in the site concept, and teasing out the data needed to address research issues can be difficult and imprecise. For the most part, however, when a site form lists a series of temporal affiliations, we count the site as one of each culturo-temporal component. For example, if we plot the distribution of Middle Archaic components, we include all sites with evidence of occupation during that era. The same site may also show up in a plotting of all Late Archaic components if evidence of that era is noted in addition to the Middle Archaic materials. The same can be said of features and artifacts.

Chapter 3

The Sites - Introduction, Their Problems, and Deconstruction

Sites and Issues

The investigations covered seven prehistoric sites located along the Cuatro Vientos project area. However, three sites, namely 41WB441, 41WB577, and 41WB578, yielded the majority of archaeological materials and are consequently the focus of the analyses. The sites cover a variety of topographical settings, generally providing a cross-sectional perspective of the landscape from uplands to upland tributary terraces to near the riverine riparian zone overlooking the Rio Grande. This diversity and the concomitant variation on the archaeological record provide one of the primary interpretive tacts in this report. This chapter provides a description of the sites and a critical evaluation of problems that present interpretive difficulties. The concern here is to establish basic characterizations of the sites and the data yielded from each. Specific details, such as the materials recovered from each provenience unit or methods used in the investigations, are provided in Appendix F.

General Overview of The Sites

The seven prehistoric sites (41WB441, 41WB572, 41WB577, 41WB578, 41WB621, 41WB622, and 41WB623) are prehistoric lithic procurement locales and open campsites. All are composed of lithic debris, tools, and burned rock scatters and features on the surface or shallowly buried in various states of preservation (Table 3.1). In a few areas, notably along San Idelfonso Creek, alluvial aggradation has preserved buried cultural deposits. As formally defined, site limits are confined to the project right-of-way, but clearly extend beyond the survey area. Consequently, the full extent of the resources is unknown.

The temporal data, primarily diagnostic artifacts but also several radiocarbon dates, indicate Middle to Late Prehistoric occupations. The diagnostics identified are primarily Tortugas, Matamoros, Desmuke, and Refugio types, which have varying degrees of typological and chronological problems. All sites have been disturbed by natural erosion as well as man-made impacts such as fences, dirt roads, and vegetation clearing. To an unknown degree, looting has been common on many of the sites. According to a local landowner, surface collecting has been a multigenerational hobby and jars and boxes of points and other tools have been collected from some of the sites. These natural and cultural post-depositional forces have created biases in the diversity

Table 3.1. Tested Sites in the Cuatro Vientos Project Area

Site	Description	Site Size (m)	Landform/Depositional Setting	Portion of Site Recommended for Testing
41WB441	Late Archaic open camp and lithic procurement area	1200 x 500	Upland divide between San Idelfonso and Chacon Creek	200 x 125 m area on southern side of site
41WB572	Late Archaic open camp and lithic procurement area	500 x 125	Uplands along minor erosional gully	Two areas along headwater drainages
41WB577	Middle to Late Archaic open camp and lithic procurement area	850 x 250	San Idelfonso Creek terraces and slopes	300 x 125 m area in southern portion of site
41WB578	Middle to Late Archaic open camp and lithic procurement area	460 x 490	San Idelfonso Creek terraces and slopes	200 x 125 m area on northern side of site
41WB621	Late Archaic open camp and lithic procurement area	120 x 115	Upland slopes	Entire site within right-of-way
41WB622	Late Archaic open camp and lithic procurement area	145 x 175	Uplands along minor headwater drainage	Entire site within right-of-way
41WB623	Late Archaic open camp and lithic procurement area	625 x 125	Uplands, upland slope, minor tributary terrace	300 x 125 m area in south central part of site

of archaeological deposits. While clearly evident, the precise effects are difficult or impossible to quantify.

As with many sites in the region, all seven sites have limitations in regards to integrity and potential data yield due to their settings and nature. Many appear to be palimpsest sites, with thousands of years of occupational debris overlapping on stable surfaces. Some appear to have somewhat restricted but substantial pockets of fine sediments that contain buried, possibly intact archaeological materials, such as site 41WB577 near San Idelfonso Creek. In many sites, only a small portion of the overall site were defined for significance testing, while much of the remainder of the site was recommended as non-significant, requiring no further work (41WB623, for instance). These recommendations were based on the nature of the sites as well as the limited techniques available to the original recorders, as no subsurface explorations beyond shovel testing were conducted. Backhoe trenching in many of the sites quickly answered many basic questions on soil depths and origins, and intactness of subsurface remains.

Site 41WB441

Introduction

Site 41WB441, the northernmost of the seven sites that were tested, is an upland prehistoric site situated on the drainage divide between Chacon Creek to the north and San Idelfonso Creek to the south. Wormser Road defines the southern boundary of the site. As delineated in several previous surveys, the site is 1.2 km in length and is about 500 m wide at its widest point, well beyond the width of the right-of-way (Figure 3.1). Only the southern portion of the site was recommended for testing, including an area measuring 250 m north-south by the 120 m east-west width of the right-of-way.

Cultural materials consist of a light scatter of lithic debris and burned rock in surficial and subsurface contexts. Three features, as discussed below, were investigated on the site. Otherwise, a few general clusters could be discerned in the artifact distributions, but not sufficiently concentrated to be clearly identifiable as a feature. In general the

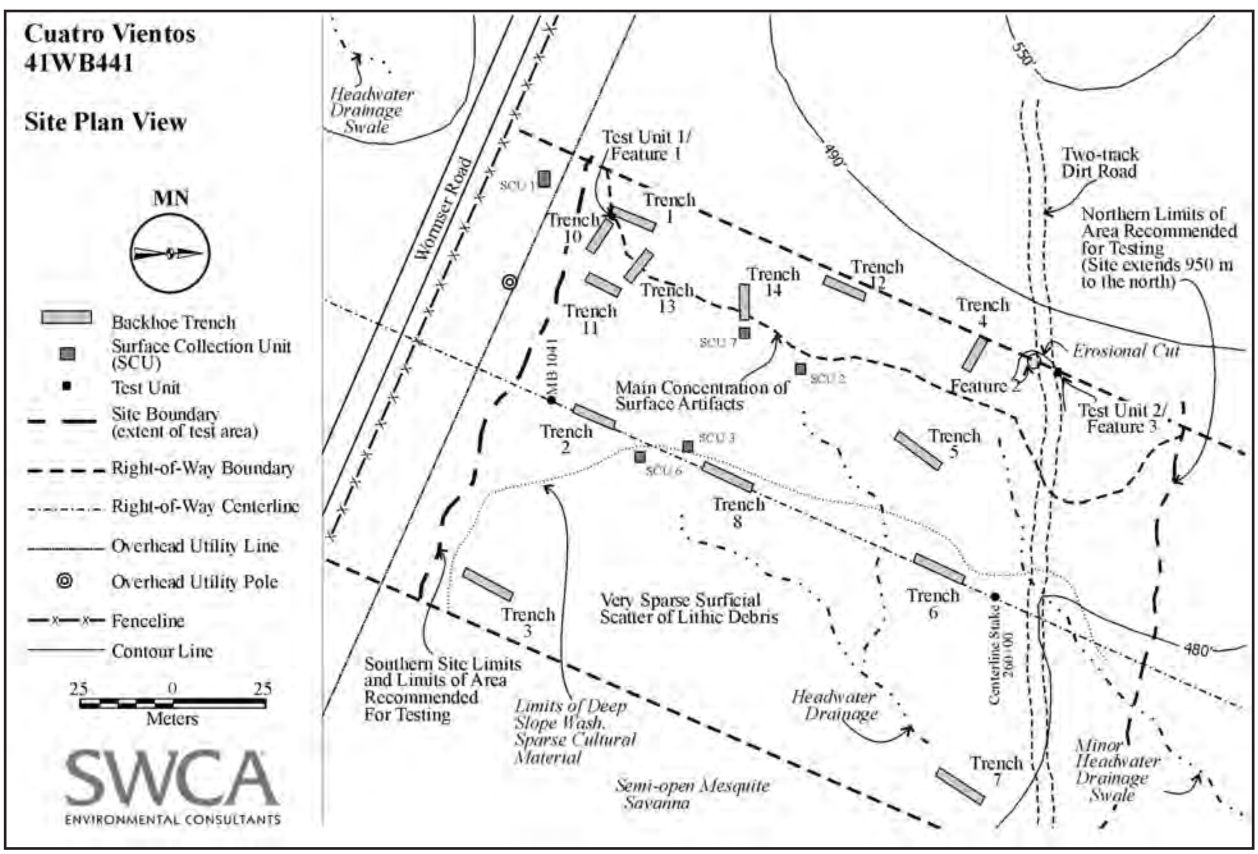


Figure 3.1. Site map of 41WB441.

materials are diffusely scattered across the area and beyond the right-of-way.

Summary of Test Investigations

SWCA's site investigations on 41WB441 included 13 backhoe trenches with column samples, two 1-x-1-m hand excavated test units, eleven 10 m^2 surface collection units, and site mapping with Global Positioning System (GPS) receiver point plotting of all formal artifacts. Additionally, an intensive re-survey of the entire site in 5-m intervals was conducted. Testing investigations covered the entire 6-acre area recommended for further work, but focused on the western half where almost all of the features and artifacts were identified. The three features, designated Features 1–3, were all burned rock concentrations, including the one previously discovered by Ringstaff et al. (2004). The eleven surface collection units were placed on the site surface to recover artifacts associated with formal or diagnostic tools, as well as collecting arbitrary data on the surface expression of the site. The collections included two projectile points, three Nueces tools, one core and one biface. For the most part, the collection units recovered debitage, which ranged from one to 105 pieces per unit (Table 3.2).

Natural Stratigraphy and Geomorphology

Slope-wash deposits blanket the site, becoming gradually thicker in the lower elevations to the north and east of the investigated area. A typical soil profile as observed in one trench includes a thin layer of brownish-yellow (10YR6/8) silty loam to a depth of about 10 cm over a brownish-yellow (10YR6/8) sandy loam to depths of 10–30 cm below surface (cmbs). A dark yellowish-brown (10YR4/4) clay loam extends beyond the sandy loam to approximately 90 cmbs before encountering degrading bedrock. For the most part these sediments are found in each of the subsurface investigations, though the thicknesses of the strata vary across the site.

Despite three radiocarbon dates and a suite of diagnostic artifacts, the chronology of the deposits is poorly defined. Two dates from shallowly buried associated features indicate a historic veneer of slope wash covering portions of the site. A date of 2,260 radiocarbon years B.P. was obtained from Feature 1 buried about 40 cmbs. The 2,000 years of deposition represented by the upper 40 cm of sediments has likely been subjected to episodic aggradation and erosion. Surficial materials, such as Tortugas points, are consistent with the Feature 1 date indicating a highly variable stratigraphic sequence across the horizontal extent of the site. Pockets of buried deposits intermixed with contemporary surficial materials. The geomorphic analysis identified mature buried soils exposed in parts of the landscape. In exposures near Features 2 and 3, the advanced degree of pedogenesis may indicate the soils date to the early Holocene or older, but no cultural materials were identified in these soils. The veneer of historic to

Table 3.2. 41WB441 Surface Collection Recovery

Site	Surface Collection Unit #	Rationale for Placement	Recovery	Notes
41WB441	1	Projectile Point (Refugio Point)	Debitage (10), Desmuke (1)	Site was arbitrarily divided into two areas, including the western half with shallow to surficial deposits and the eastern half with very rare surface deposits and up to several m of fine sediment. SCU's 1 through 7 were in the western half on diagnostic artifacts, which provided concentrated coverage of lithic landscape. SCU's 8 through 11 were arbitrarily placed throughout the site to assess the probablistic nature of artifact patterning.
	2	Diagnostic Biface (Nueces Tool)	Debitage (5), Nueces (1)	
	3	Projectile Point	Debitage (4), Tortugas (1)	
	4	Biface	Debitage (13), Biface (1)	
	5	Bifacial Core	Debitage (18), Core (1)	
	6	Location of tool plotted during previous survey	Debitage (104), Nueces (1)	
	7	Location of tool plotted during previous survey	Debitage (51), Nueces (1), Mussell Shell (1)	
	8	Arbitrary placement to assess background "noise"	Debitage (2)	
	9	Arbitrary placement to assess background "noise"	Debitage (1)	
	10	Arbitrary placement to assess background "noise"	Debitage (6)	
	11	Arbitrary placement to assess background "noise"	Debitage (7	

Table 3.3. Site 41WB441 Burned Rock Features

Site	Feature No.	Max Diameter	Temporal Affiliation	Basis for Determination
41WB441	1	ca 100 cm	Late Middle Archaic	2320 B.P C-14 date
41WB441	2	50 cm	Late Prehistoric or Historic	390 B.P C-14 date
41WB441	3	35 cm	Late Prehistoric or Historic	430 B.P. C-14 date

modern slope wash on both the concave and convex slopes may post-date modern brush clearing.

Archaeological Findings

The testing investigations assessed and recovered three features and 265 artifacts, consisting almost exclusively of lithic reduction debris and various formal and informal stone tools.

Features

Features 1, 2, and 3 are prehistoric hearth-like burned rock or charcoal concentrations (Table 3.3). Each is briefly described here in the context of the site and analyzed in greater detail in Chapter 5, where it is assessed in the broader regional context.

Feature 1

Feature 1 was an intact rock-lined hearth with an apparent slight basin-shaped morphology. The feature was first identified on the basis of several calcium carbonate-coated cobbles and gravels in the southeastern trench profile of Trench 1 at about 30–40 cmbs. The feature was fully exposed in Test Unit 1 placed along the trench wall.

Based on the profile and basin shape, the surface of origination appeared to be around 39–40 cmbs, or precisely at the contact between a loamy clay BC horizon and the lower degrading bedrock. The feature comprises 135 rocks with a total weight of 28.61 kg. Dimension of the overall feature was about 90 cm in diameter, though the northern edge was truncated by the backhoe trench. Organic sediments taken from below the burned rock yielded a radiocarbon date of 2,260 B.P. as previously noted. This date lies on the cusp of the late Middle Archaic and Late Archaic. Though clearly intact, four backhoe trenches and three column samples identified no associated features or clearly discernible cultural surface in the vicinity.

Pollen/phytolith and macrobotanical matrix samples were collected from Feature 1 and analyzed (Appendixes B and C). The pollen profile revealed many of the common plant species of the area, but also *Pinus* pollen of pinyon and ponderosa pines, which is no longer indigenous to the area. However, pine pollen travels vast distances, and its occurrence may not indicate local presence or use of the species. The primary economic plant identified in the pollen profile is prickly pear, which has numerous edible components. The macrobotanical analysis yielded wood charcoal fragments with structures consistent with either mesquite of acacias.

Feature 2

Feature 2, which was previously designated Feature 26 during the previous site survey (see Ringstaff et al. 2004), was a burned rock feature with charcoal stained sediments eroding from a modern gully. Three fossiliferous sandstone tabular cobbles, underlain by several cm of carbon staining, were exposed in the erosional profile. A substantial part of the feature has been washed downslope; about 10-15 rocks, apparently part of the feature, are located in the gully within 10 m of the intact remains. The remaining feature suggests a very slight basin shape, measuring approximately 40–50 cm in diameter. Stratigraphically, the feature was about 25 cmbs and 5 cm above a gravelly caliche layer, which in turn overlay degrading bedrock and clays. A sediment sample replete with charcoal yielded a corrected date of 390 B.P., which is Late Prehistoric to Historic in age. Given the problem of old wood, the feature is plausibly firmly historic in age, as further discussed in Chapter 4.

Pollen and macrobotanical matrix samples were collected, but were not submitted for analysis. Given the very shallow nature of the feature and exposure of substantial portions of the feature in an erosional gully, the context of any floral remains would be a bit uncertain.

Generally, the feature can be interpreted as a hearth-like feature, but too much had been washed away to clearly determine much else on its morphology or function. The rocks are not extensively thermally fractured suggesting limited heating and re-use.

Feature 3

Feature 3 was identified in Test Unit 2, located about 2 m north of Feature 2 and was most likely an ash plume or toss zone associated with the hearth. Feature 3 is an approximately 25–35 cm diameter charcoal and ash stain buried about 10–15 cmbs. Immediately south of the unit, a ranch road and erosional cuts yielded no further evidence of the feature, suggesting it to be very localized and not extending much beyond the test unit. The excavations uncovered a thin veneer of ash and charcoal that sloped gradually downslope from north to south, with a 5 cm thick concentration in the southwest corner of the unit. No burned rock or debitage was recovered from the feature.

A single radiocarbon assay of the feature ash yielded a corrected age of 430 B.P., which based on the 2-sigma calibration is substantially coincidental with the Feature 2 date.

The macrobotanical analysis identified various local species of scrubby plants such as various acacias and whitebrush, but also unidentified hardwood. The remains included both carbonized and uncarbonized. Based on the comparison of the two sets, burned and unburned, Bush (Appendix C:3) notes “because the carbonized macrobotanical remains are consistent with the uncarbonized remains, the possibility that these are also of recent origin must be considered. The feature may represent a modern burning event.”

Based on the cumulative evidence, both Features 2 and 3 may represent a modern or Historic rock-lined campfire. If mesquite, positively identified in one of the features, were the fuel source, the old-wood problem could substantially skew the age by hundreds of years.

Artifacts

Materials recovered included 249 pieces of debitage, six projectile points, seven bifaces, three Nueces Tools, and a core (Table 3.4). A majority of the recovered artifacts came from the surface collection units. The projectile points include a Fresno arrow point, two Late Archaic Tortugas, and unidentified subtriangular forms, possibly a Desmuke and a Matamoros (Appendix B).

Table 3.4. 41WB441 Testing Recovery

Artifact Category	Quantity	Description
Projectile Points	6	2 Tortugas, 1 Desmuke, 1 Matamoros, possible Fresno Arrow point, and unidentified subtriangular form
Debitage	249	All stages of reduction
Features	3	Features 1, 2, and 3
Cores	1	one clearly identified core recovered
Bifaces	7	Primarily small late stage pieces, possibly point fragments
Formal Tools	3	Nueces tools
Mussel Shell	2	1 Possibly associated with Feature 1

Site 41WB572

Introduction

Site 41WB572 is prehistoric site situated on the western upland margin slopes of the San Idelfonso Creek valley. As currently delineated, the site extends for about 0.5 km north-south along the width of the right-of-way (122 m wide) (Figure 3.2). Deposits extend beyond the survey area. Vegetation, which is fairly sparse, includes an assemblage dominated by mesquite, prickly pear, and creosote bush. Lag gravel formations are intermittently exposed on the site. Soil at the site is mapped as Verick fine sandy loam (Sanders and Gabriel 1985), which form on the calcareous sandstone substrate of the Laredo Formation.

Cultural materials consisted of thee burned rock features, lithic reduction debris, diagnostic artifacts, and a diffuse light scatter of lithic debris and burned rock. The artifacts and features are concentrated in two main areas, each of which is located along the drainage swales of minor headwater gullies. The features are in varying stages of preservation, and several extend into intact sediments. Numerous temporally non-diagnostic artifacts were observed including cores, early and late-stage bifaces, as well as abundant lithic debitage. Based on the presence of hearths and lithic reduction materials, the site is interpreted as a small camp and procurement area.

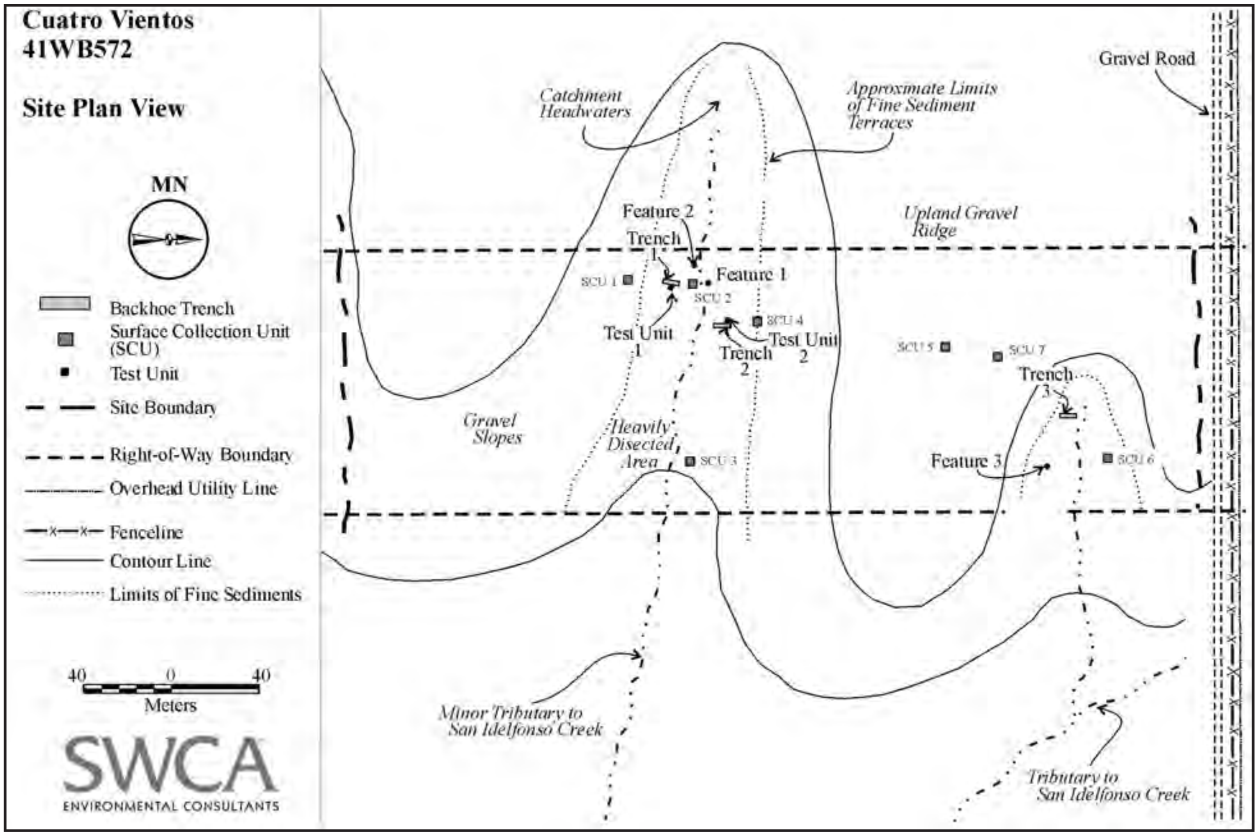


Figure 3.2. Site map of 41WB572.

Summary of Test Investigations

SWCA's investigations on site 41WB572 included the excavation of three backhoe trenches with column samples, two 1-x-1-m hand excavated test units, seven 10 m^2 surface collection units, investigation and sampling of three of the 10 previously recorded features, and site mapping with point plotting of formal artifacts. Testing investigations concentrated on areas adjacent to the southern gully where the majority of the previously identified features were located (Ringstaff, et al. 2004). Due to the minimal amount of observed projectile points or formal tools on the surface of site 41WB572, a majority of the surface collection units was placed in locales to investigate debitage concentration along differing topographical settings throughout the site. The surface collection units mostly recovered debitage with tools of only one projectile point (Tortugas) and four bifaces (Table 3.5).

Natural Stratigraphy and Geomorphology

The site is upon the remnants of a Tertiary-aged Rio Grande terrace high above its modern depositional plain. The majority of the site consists of boulders and gravels laid down as part of an ancient bed load that now caps high surfaces. These gravels provide a wide diversity of lithic resources, including cherts, chalcedony, quartzite, and various coarse to fine-grained igneous and sedimentary stone.

Localized deposition has occurred from the minor headwater tributaries that cut through the site. Slightly buried features were observed in the walls of gullies and upon the upland projection that separates the northern and southern halves of the site (Figure 3.3).

Archaeological findings

Testing investigations assessed and recovered three features and 403 artifacts, which consist mainly of lithic reduction debris. A substantial portion of the site is a pavement of lithic resources, much of which has been tested. Consequently, early stage reduction material is common across the site.

Table 3.5. 41WB572 Surface Collection Recovery

Site	Surface Collection Unit #	Rationale for Placement	Recovery	Notes
41WB572	1	Projectile Point (Tortugas Point)	Debitage (27), Tortugas (1)	Site was arbitrarily divided into upland area, slopes, and terraces. SCUs 4 and 7 were on slopes. SCU 5 was on upland area. SCU 6 was on the terrace, slope confluence. SCU 2 was arbitrarily placed in a burned rock scatter on terraces.
	2	In a area eroding from of fairly dense cluster of features.	Debitage (76)	
	3	Subtriangular "Tortugas like" Biface and several other Bifaces in the area.	Debitage (98), Biface (4), Core (2)	
	4	Arbitrary/random placement on the colluvial slopes.	Debitage (90)	
	5	Arbitrary/random placement on upland portion of site.	Debitage (3)	
	6	Arbitrary/random placement on the margin of upland toeslope gravels and terrace deposits, near an eroding burned rock feature.	Debitage (39)	
	7	Arbitrary/random placement on an upland slope bench with colluvial gravels and a thin veneer of fine sediments. Area was a mid-slope occupational surface.	Debitage (18)	

Features

The three features were burned rock or charcoal concentrations, each in varying stages of erosion (Table 3.6). Though radiocarbon, pollen/phytolith, and macrobotanical samples were collected from each of the features, the heavily eroded or surficial contexts posed contamination problems. Consequently, none of the samples were submitted.

Feature 1

Feature 1 was a heavily eroded scatter of burned rocks, a few retaining charcoal-stained sediments beneath them (Figure 3.4). The feature was located within the southern arroyo, and therefore a majority of the feature had been eroded downslope to the northwest and incised to the east by a gully with a relief of approximately 50 cm. As a result of the degraded context, few traces of the original feature structure remain. Though the dimensions are problematic, the approximate measurements of the core component were 1 m north to south and 50 cm east to west, the eastern portion being truncated by the wash.

The feature consisted predominantly of sandstone burned rock. Bisecting the feature revealed limited subsurface expression with no apparent sub-structure such as a rock-lined pit. Samples taken from the feature matrix include three charcoal samples, pollen/phytolith, and macrobotanical matrix samples. Overall, Feature 1 appeared to be a heavily eroded hearth of unknown cultural-temporal affiliation.

Figure 3.3. Investigations of a feature on 41WB572. Note the drape of naturally occurring gravels and cobbles in the background.

Table 3.6. Site 41WB572 Burned Rock Features

Site	Feature No.	Max Diameter	Temporal Affiliation	Basis for Determination
41WB572	1	100 cm	Indeterminate	No data
41WB572	2	100 cm	Indeterminate	No data
41WB572	3	70 cm	Indeterminate	No data

Feature 2

Feature 2 was a concentration of rocks, predominantly sandstone, situated in a circular pattern on the surface. Due to the feature's proximity to an arroyo, the upper portions of the feature may have been eroded leaving a deflated layer of burned rock capping the intact portion of the feature (Figure 3.5). This feature, unlike the other two investigated on site 41WB572, appeared to have some subsurface integrity. The dimensions of the circular feature were 95 cm in maximum diameter.

In addition to the intact portion of the feature, a cluster of large burned rocks appeared to have eroded a few meters downslope to the northeast. The feature was bisected to reveal a slight basin shape at a maximum depth of 20 cmbs. Samples were taken from the feature matrix including two charcoal samples and pollen/phytolith and macrobotanical matrix samples. Overall, Feature 2 appeared to be a partially intact hearth of unknown cultural-temporal affiliation.

Feature 3

Feature 3, located adjacent to the northern arroyo along the eastern edge of the right-of-way, could not be clearly identified as a prehistoric feature. Measuring about 70 cm in maximum diameter, the feature was a small cluster of rock consisting of chert, quartzite, and sandstone (Figure 3.6). Little if any thermal fracturing could be discerned among the rocks. The feature was bisected, revealing no staining or carbon present. All burned rock was recovered as well as a soil sample from the matrix immediately adjacent to the burned rock. The feature is interpreted as possibly a hearth or fireplace ring, but it could very likely be a modern feature rather than a prehistoric one. The lack of thermal fracturing or subsurface expression suggests a short-term use, perhaps a single use.

Figure 3.4. Feature 1 at site 41WB572 showing its heavily eroded context. Looking northwest.

Artifacts

Materials recovered included 397 pieces of debitage, one projectile point, four bifaces, and one Nueces tool (Table 3.7). A majority of the artifacts recovered came from the surface collection units (~351 pieces of debitage). The projectile point is a late Middle Archaic Tortugas. Twenty-seven pieces of debitage were collected from Surface Collection Unit 1, which was placed at the location of the Tortugas point. The remaining surface collection units were placed around tools or upon select lithic reduction areas. Debitage recovered in the surface collection units ranged from three to 98 pieces of lithic debitage per unit.

Figure 3.5. Feature 2 at site 41WB572 eroding into an adjacent gully, facing north.

Site 41WB577

Introduction

Site 41WB577 is an upland prehistoric lithic procurement locale and open campsite located on the flood plain north of San Idelfonso Creek. This long site includes upland slopes, as well as terrace deposits. It was recorded as extending approximately 850 m north-south and an estimated 250 m wide, which is well beyond the 122-m wide right-of-way (Figure 3.7). Previous investigations recovered buried cultural materials to 1 m deep in the flood plain on the southern site margins. Focusing primarily on the possibility of intact buried deposits, SWCA's investigations were limited to a the southern end of the site, approximately 200 m long from San Idelfonso Creek to limits of upland gravels along the northern edge of the alluvial terraces.

Modern distubances to the site were common and extensive. The site area has been subject to extensive brush clearing with bulldozers. Several years ago, according to a ranch foreman, the landowners sought to establish semi-open grasslands to support game and livestock. Efforts to eradicate mesquite, huisache, and dense brush involved mechanical clearing of almost the entire area of the site subject to testing. Despite their efforts, or because of them, a dense forest of mesquite reclaimed the site.

Vegetation on the site varies across the ecological zones from riparian to upland. At its southern end, a moderately dense assemblage of willow, paloverde or retama, mesquite and other trees occupy the nearly level, often saturated, soils of the flood plain, which is part of an artificial reservoir with seasonally ranging water levels. Near the water, a huisache thicket grows along the edge of permanently marshy ground and a small pond containing various riparian and wetland species. Soils at the site are mapped as Verick fine sandy loam; Copita fine sandy loam, which is located along the valley margin and upper flood plain, and Tela sandy clay loam, which are on the flood plain closer to the drainage (Sanders and Gabriel 1985).

The site materials include two burned rock features, debitage, and various lithic tools, including a Refugio (observed during the initial surveys), a Tortugas

Figure 3.6. The questionable Feature 3, consisting of a rather vague cluster of primarily unburned rock.

Table 3.7. 41WB572 Testing Recovery

Artifact Category	Quantity	Description
Projectile Points	1	Tortugas point
Debitage	397	
Features	3	Features 1, 2, and 3
Bifaces	4	1 Late, 1 mid, and 2 Early stage
Formal Tool	1	Nueces
C-14 Sample	6	From Features 1 and 2
Organic Sample	1	Seeds from Feature 1
Bulk Matrix	2	From Features 2 and 3

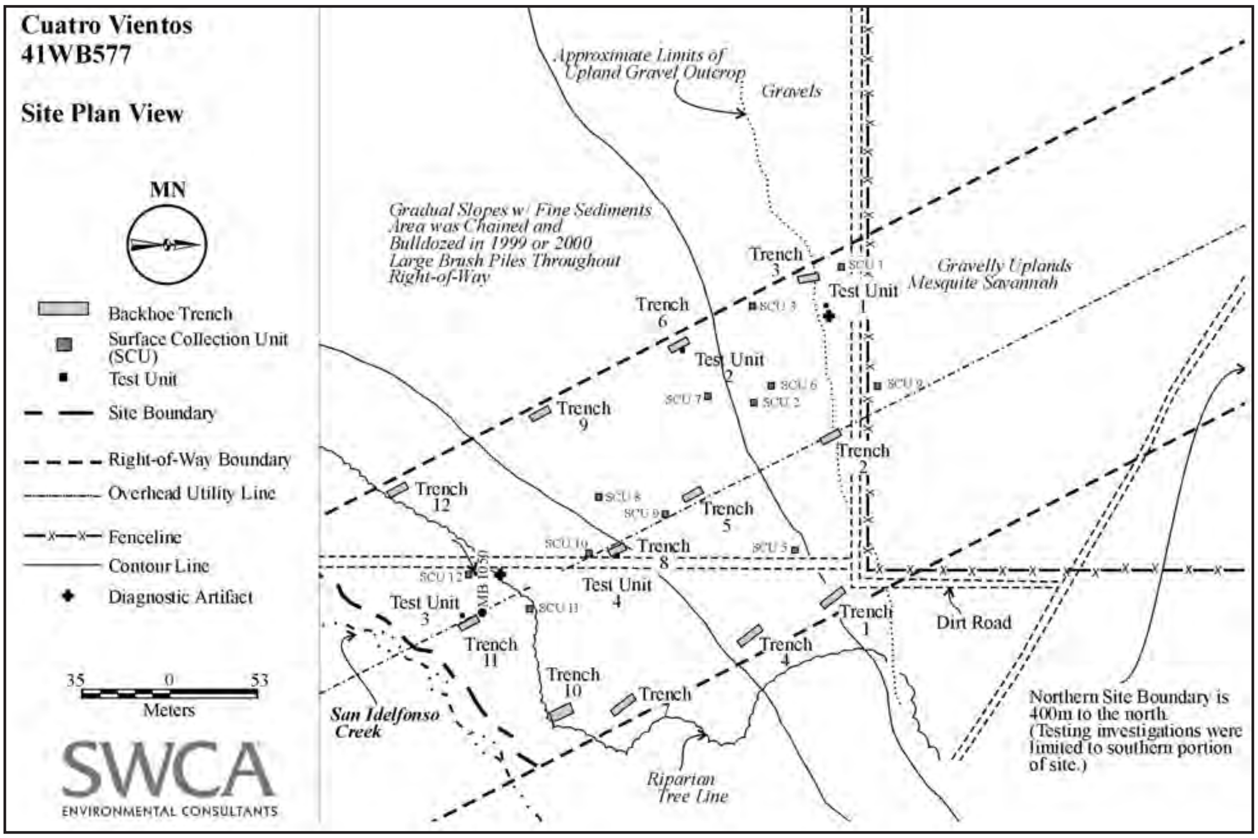


Figure 3.7. Site map of 41WB577.

point, and three Nueces bifaces. Most of the materials are scattered across the site surface. The previous investigations also noted extensive gravel deposits in the northern portion of the site that were exploited for tool quality raw materials.

Summary of Test Investigations

Test investigations on site 41WB577 included 12 backhoe trenches with column samples, four 1-x-1-m hand excavated test units, fifteen 10 m^2 surface collection units, and site mapping with point plotting of formal artifacts. All testing investigations took place within the flood plain portion recommended for exploration by the previous surveys. Trench placement covered the entire floodplain portion of the site and revealed shallow to deep deposits. For the most part, the trenches revealed sand and sandy loam soils over clays and clay loams. The trenches were placed three across within the right-of-way from north to south with depositional soils being deeper towards the middle portion of the flood plain. The amount of cultural materials recovered varied by the

Table 3.8. 41WB577 Surface Collection Recovery

Site	Surface Collection Unit #	Rationale for Placement	Recovery	Notes
41WB577	1	Core	Debitage (2), Core (1)	Replete with nondiagnostic tools, a cross-section of the different settings of the site was obtained by the location of units on tools.
	2	Undiagnostic Biface location	Debitage (15), Biface (1)	
	3	Undiagnostic Biface location	Debitage (60), Biface (1)	
	4	Undiagnostic Biface location	Debitage (13), Nueces (1), Biface (1)	
	5	Unifacial tool location	Debitage (8), Nueces (1)	
	6	Undiagnostic Biface location	Debitage (3), Biface (1), Core (1)	
	7	Undiagnostic Projectile Point base fragment	Debitage (8), Nueces (1), Biface (2)	
	8	Undiagnostic Biface location	Debitage (13), Biface (1)	
	9	Utilized Flake	Debitage (1), Informal Tool (1)	
	10	Undiagnostic Biface location	Debitage (1), Biface (1)	
	11	Undiagnostic Biface location	Debitage (16), Biface (1)	
	12	Undiagnostic Biface location	Debitage (58), Biface (1)	
	13	Arbitrary/random placement	Debitage (11)	
	14	Arbitrary/random placement	Debitage (19)	
	15	Arbitrary/random placement	Debitage (17)	

individual trench location within the flood plain. Four test units were excavated in areas with a potential for buried deposits. The fifteen surface collection units were placed on the site surface to recover artifacts associated with informal or diagnostic tools. The collections included 198 pieces of debitage, three tools, and 13 bifaces. For the most part, the collection units recovered debitage, which ranged from 1 to 60 pieces per unit (Table 3.8).

Natural Stratigraphy and Geomorphology

The geomorphic assessment interprets the site as an upland gravel and exposed bedrock formation on an upland terrace leading south into a large flood plain on the southern portion of site 41WB577. Slope deposits interfinger with overbank sediments along the toeslope before reaching the fluvial overbank deposits of the flood plain on the southern portion of the site. The flood plain deposits cover and approximate an area 500 m north-south and the entire portion of the site within the right-of-way. These flood plain deposits were the focus of the subsurface investigations. The soils assessment and a review of the topographic information from aerials and USGS quadrangle maps, suggest the possibility of a sediment-filled ancient channel of San Idelfonso Creek bisecting the flood plain portion of the site.

Archaeological Findings

Testing investigations assessed and recovered one feature and 795 artifacts consisting mainly of lithic reduction debris and informal and formal stone tools.

Features

Feature 1 was a small burned rock cluster with a light scatter of charcoal flecking and a small amount of debitage. The feature was encountered in Level 5 of Test Unit 1, located along Trench 6, and extended from 42–51 cmbs. The intact portion of the feature measured approximately 60 cm in diameter with a circular pattern in planview. Approximately half of the feature was removed by the trench.

The feature consisted mainly of burned sandstone fragments with several smaller rocks extending beyond the periphery of the main feature location. Besides the cluster, no clear basin-shaped morphology could be defined in the profile. Evidence of burning in the surrounding sediments consisted of charcoal flecking among the burned rocks, but no substantial charcoal. A bulk matrix radiocarbon sample was taken from throughout the concentration yielded a

Table 3.9. 41WB577 Testing Recovery

Artifact Category	Quantity	Description
Projectile Points	1	1 Tortugas
Debitage	763	
Features	2	Features 1 and survey identified feature
Bifaces	22	
Formal Tools	3	Nueces
Informal Tools	5	Mostly utilized flakes
Core	1	
Mussel Shell	5	
C-14 Sample	1	From Feature 1
Organic Sample	20	Faunal remains
Bulk Matrix	1	From Feature 1

date of 1,670 B.P., within the Transitional Archaic Period.

Macrobotanical analysis identified one identifiable plant part, a bulb fragment, likely a wild onion or garlic native to areas along south Texas streams (Appendix C). No pollen or phytolith samples were run because of the poor results from other features in similar contexts as well as partial truncation of the feature by the backhoe.

Artifacts

The 795 artifacts recovered from the site include 763 pieces of debitage, 22 bifaces, five informal tools, one projectile point, one core, and three Nueces tools (Table 3.9). The projectile point is the proximal end of a Tortugas point. Ten of the bifaces represent thinly flaked bifacial fragments. From the surface collection units, a total of 198 pieces of debitage, including ten bifaces, was recovered. These collections ranged from one to 60 pieces of debitage with a majority recovering less than 20 pieces of debitage.

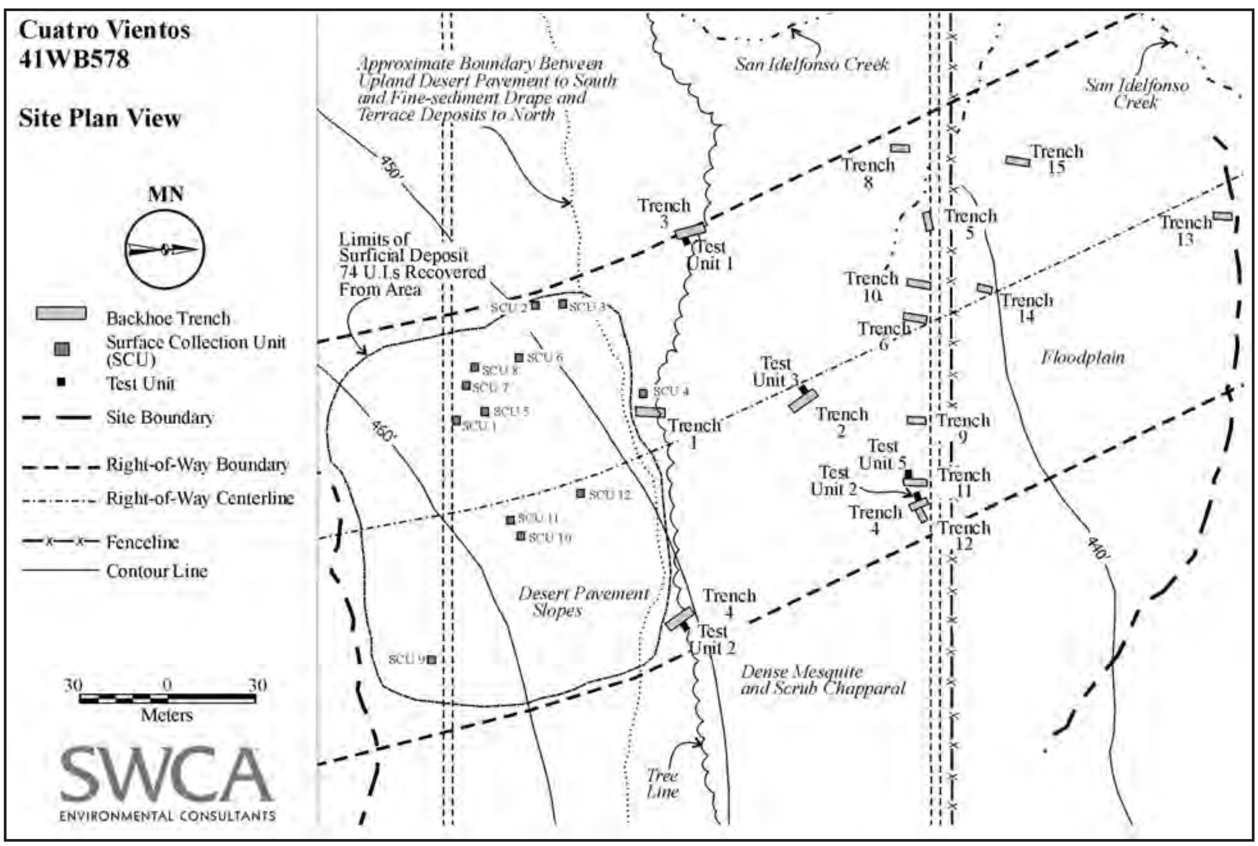


Figure 3.8. Site map of 41WB578.

Site 41WB578

Introduction

Located on the opposite banks from 41WB577, site 41WB578 is a large prehistoric open campsite and lithic procurement site in the flood plain and adjacent upland ridge along the south side of San Idelfonso Creek. The site contained perhaps the densest concentrations of cultural materials in the Cuatro Vientos project area. Portions of the site are covered with lithic raw materials that have been tested and reduced, leaving a desert pavement of various stages of lithic debris. The site dimensions are 460 m north-south by an estimated 490 m east-west, far beyond the limits of the right-of-way (Figure 3.8). It is bounded by a tributary stream to the west, San Idelfonso to the north, and extends an unknown distance to the east.

Vegetation at the site varies with elevation. An overstory and thick low grass covers the flood plain, obscuring surface visibility. Semi-open arid vegetation is situated on the remainder of the site where surface visibility is good. Soil series mapped at the site consist of Tela sandy clay loam on the flood plain, Maverick-Catarina complex along the lower slopes, and Copita fine sandy loam on the top of the ridge (Sanders and Gabriel 1985). As noted in the description of the adjacent 41WB577, Tela sandy clay loams are deep soils formed in alluvium along upland drainages. The Maverick-Catarina complex consists primarily of loamy shaley soils in a diverse topographic setting from uplands to valley terraces.

Lithic tools and debitage were observed across a broad area extending approximately 240 m southeast of the San Idelfonso channel. This area marks a toeslope transition from a gravel-covered upland to the southeast, to the deeper alluvial and colluvial sediments to the north, as demonstrated by shovel testing in the previous survey and trenching during SWCA testing.

Test Investigations

SWCA's investigations on site 41WB578 included the excavation of 15 backhoe trenches with column samples on eight of the trenches, five 1-x-1-m hand excavated test units, seventeen 10 m^2 surface collection units, and site mapping with point plotting of formal artifacts. Testing investigations covered the entire site within the right-of-way, but focused on the southern portion of the site recommended for further work by the previous surveys.

Trenches revealed shallow deposits on the southern portion of the site with gradually deeper deposits heading north to northwest within the flood plain and closer to San Idelfonso Creek. In general, the trenches and column samples yielded very sparse prehistoric material. A burned rock hearth designated Feature 1 was found in Trench 3, and Test Unit 1, discussed below, was placed over the feature to further investigate. Feature 2, a burned rock cluster, was found in the wall of Trench 7, and Test Unit 4 was used to investigate this feature. Of the remaining trenches, no features or artifacts were identified.

A large number of diagnostic tools and projectile points were located on the surface and seventeen surface collection units were placed throughout the southern portion of the site. The surface collection units recovered a large amount of debitage in addition to 74 formal and informal tools (Table 3.10).

Natural Stratigraphy and Geomorphology

The site consists of three basic geomorphic settings, degrading bedrock, colluvial slopes, and alluvial terraces. Eocene Laredo formation sandstones are exposed on the southern part of the site. Eroding downslope from this formation, siliceous gravels cover the slopes, eventually interfingering with overbank alluvial sediments. The flood plain, approximately 200 m wide, includes braided relict channels that have reworked the terrace deposits, forming a complex stratigraphy.

In this context, the main concentration of cultural material was along the lower slopes at the conjunction of the riparian vegetation and the upland lithic resources. This part of the site is approximately 1 m above the flood plain.

Archaeological Findings

Testing investigations recorded and recovered two features and 4,530 artifacts, consisting mainly of lithic reduction debris and informal and formal stone tools. The two features were hearth-like burned rock concentrations exposed in the walls of Trenches 3 and 7.

Table 3.10. 41WB578 Surface Collection Recovery

Site	Surface Collection Unit #	Rationale for Placement	Recovery	Notes
41WB578	1	Placed on toeslope and location of Projectile Point	Debitage (202), Langtry (1), Core (1), Biface (1)	Replete with diagnostics, a crosssection of the different settings of the site was obtained by the location of units on diagnostic artifacts and tools.
	2	Location of Projectile Point	Debitage (765), Nueces (1), Refugio (1), Biface (3)	
	3	Location of undiagnostic Biface (probable Projectile Point fragment)	Debitage (303), Tortugas (2), Biface (5), Informal Tool (1), Core (1)	
	4	Area of burned rock concentration and Projectile Point	Debitage (584), Tortugas (2), Matamoros (1), Biface (4), Core (2)	
	5	Location of Projectile Point fragment	Debitage (646), Biface (17), Core (5), Informal Tool (8)	
	6	Undiagnostic Biface location	Debitage (515), Nueces (1), Biface (9), Core (3), Informal Tool (3)	
	7	Location of Projectile Point	Debitage (341), Langtry (1), Tortugas (1), Untyped Projectile Point (1), Biface (4), Informal Tool (1), Core (1)	
	8	Location of Projectile Point (Triangular)	Debitage (60), Tortugas (1), Matamoros (1), Biface (1), Informal Tool (2), Core (1)	
	9	Location of Projectile Point	Debitage (65), Caracara (1)	
	10	Location of Projectile Point	Debitage (129), Ensor (1), Biface (2), Core (3)	
	11	Location of Biface (probable Projectile Point)	Debitage (138), Tortugas (1), Biface (3), Core (1)	
	12	Location of Projectile Point (Triangular)	Debitage (74), Tortugas (1), Informal Tool (1)	
	13	Location of Projectile Point	Debitage (159), Pandora (1), Biface (2), Core (2), Informal Tool (1)	
	14	Arbitrary/random placement	Debitage (73), Biface (1), Core (1)	
	15	Arbitrary/random placement	Debitage (15), Biface (1), Core (1)	
	16	Arbitrary/random placement	Debitage (65)	
	17	Arbitrary/random placement	Debitage (117), Biface (1), Core (4)	

Table 3.11. Site 41WB578 Burned Rock Features

Site	Feature No.	Max Diameter	Temporal Affiliation	Basis for Determination
41WB578	1	74 cm	Early Middle Archaic	4150 B.P. C-14 date
41WB578	2	50 cm	Indeterminate	No data

Features

Two features were investigated on 41WB578, both in subsurface contexts (Table 3.11). Based on a radiocarbon date, Feature 2 defines the earliest identified occupation in the project area.

Feature 1

Feature 1, upon initial discovery in the profile of Trench 3, appeared to be a few isolated, shallowly buried sandstone fragments. Further investigation with Test Unit 1 revealed a cluster of rocks, many of which appear to have been thermally fractured in a roughly 50 cm-diameter cluster. The feature is interpreted as a small hearth-like feature, but no other evidence, such as staining, charcoal, or a shallow pit, could be identified to clearly support such a determination.

Feature 2

Feature 2 is a distinct burned rock cluster encountered in the Trench 7 profile at a depth of 115 cmbs. Test Unit 4 was placed over the cluster in the profile and exposed most of the feature in planview, revealing a discrete intact cluster of burned rock in an ovate pattern. The feature extended into the western wall of the test unit, although a significant portion was exposed and sampled. The cross section revealed a very slight basin shape. From the exposed portion, the feature dimensions can be approximated to 80 cm in diameter. Fourteen burned rocks were recovered from the feature, with a majority being between 5–10 cm in maximum dimension.

A radiocarbon date obtained from charcoal recovered from beneath rocks yielded a date of 4,150 B.P., which falls within the early Middle Archaic. A macrobotanical analysis of the bulk matrix unfortunately did not recover any floral remains (Appendix C). The pollen sample identified almost the same species found on site 41WB441, which may suggest a pollen signature that reflects a common background rather than distinctive economic species directly exploited in association with the hearths.

Feature 2 was the best preserved, most discrete burned rock feature encountered in the Cuatro Vientos project area. The depositional setting was clearly conducive to preservation of the feature, which was likely buried rather quickly after its abandonment. Intensive efforts were made to further explore the area, possibly to identify a buried component or surface. However, additional test units, backhoe trenches, and column samples failed to yield indications of additional features or a substantial component. Additionally, the various excavation units showed substantial variation in sediments across short distances, which suggested quite a bit of discontinuity in the stratigraphic units throughout this portion of the site. Lateral migration and braided stream channels likely resulted in a patchwork of horizontally discontinuous depositional units, leaving isolated areas of good preservation. Feature 2 was one of those areas.

Artifacts

Artifacts recovered in testing include 4,536 artifacts, including 19 projectile points, 97 bifaces, 33 cores, 19 informal tools, and two Nueces tools (Table 3.12). From the diagnostic projectile points recovered, it can be deduced that site 41WB578 represents multiple occupational periods. The projectile points present include one Middle Archaic Langtry and one specimen with Langtry characteristics with modified or damaged shoulder. Other Archaic specimens include one Refugio, eight late Middle Archaic Tortugas points, and one untyped archaic-like projectile point. The untyped projectile point has a slight lanceolate shape possibly due to modified lateral edges and damaged or modified basal corners leading to a concave base. Younger specimens include two Late Archaic to Late Prehistoric Matamoros points, a Transitional Archaic Ensor, a Late Prehistoric Caracara, and one arrow point with Caracara features. In addition, artifacts recovered include several late stage bifacial fragments, utilized flakes, modified flakes, and crude bifaces and biface fragments.

Table 3.12. 41WB578 Testing Recovery

Artifact Category	Quantity	Description
Projectile Points	19	8 Tortugas, 2 Matamoros, 1 Ensor, 1 Refugio, 2 Langtry, 2 Caracaras, and 3 untyped
Debitage	4366	
Features	2	Features 1 and 2
Cores	33	
Bifaces	97	Late stage to crude bifaces
Formal Tools	2	Nueces
Informal Tools	19	Utilized and edge-modified flake
Mussel Shell	2	
Organic Sample	1	1 seed from Feature 1
Bulk Matrix	4	From Features 1, 2

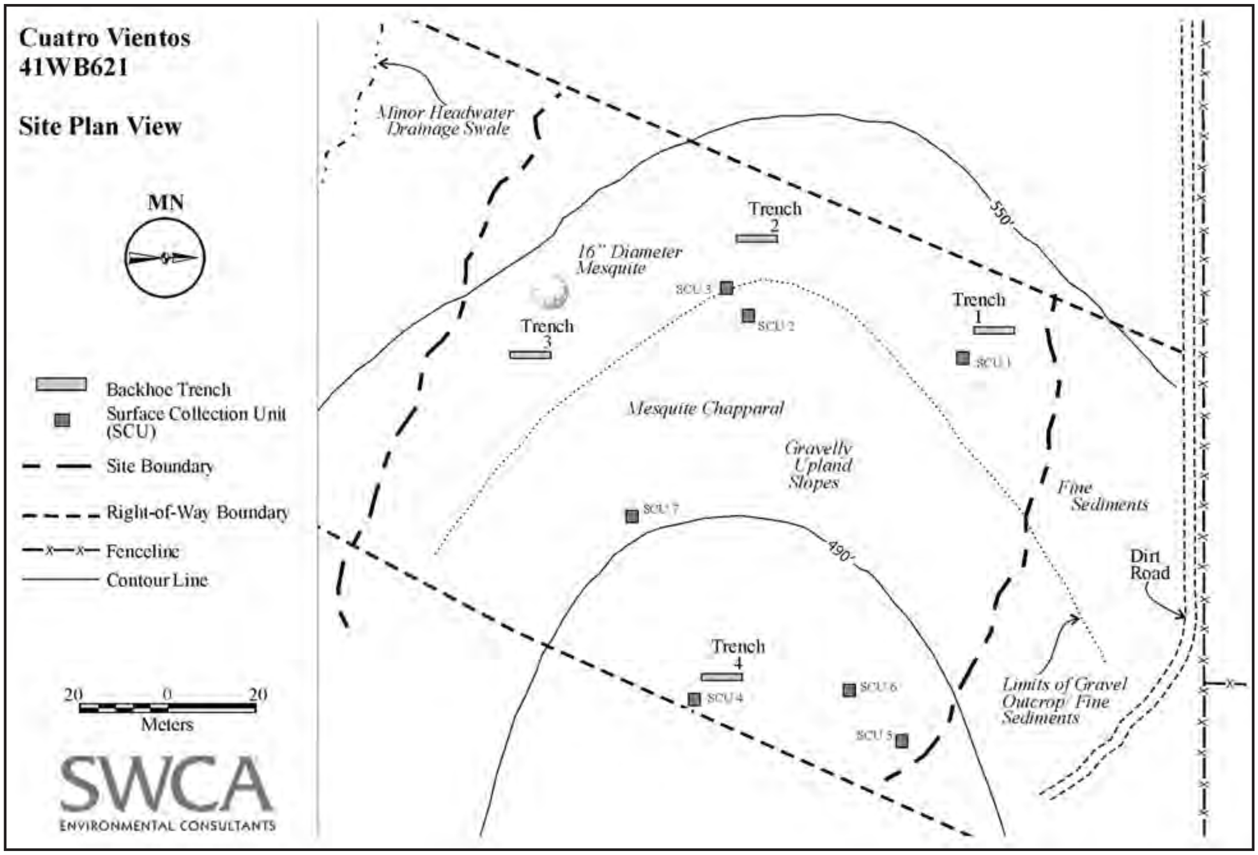


Figure 3.9. Site map of 41WB621.

A majority of the artifacts recovered from the site came from surface collection units. Four 3,981 pieces of debitage, as well as 51 bifaces and two Nueces tools, were recovered from the 13 surface collection units placed on the site. The collection units ranged from 60–646 pieces of debitage recovered per unit.

Site 41WB621

Introduction

Site 41WB621 is a prehistoric lithic procurement locale consisting of a diffuse, undifferentiated scatter of primarily early stage reduction debris located on a broad upland plain approximately 400 m southwest of the head of an unnamed, generally north-flowing tributary of San Idelfonso Creek. The cultural materials lie among an upland outcrop of ancient river gravels that provide an abundant source of raw materials. The site is 1.3 km south of San Idelfonso Creek. The site is approximately 120 m north-south by 115 m east-west (Figure 3.9).

Vegetation at the site consists of a few scattered, older mesquites, but brush dominates the site including whitebrush, blackbrush, prickly pear, tasajillo, huisache, and buffelgrass. Site visibility was high at around 75 percent. Soil at the site is mapped as Copita fine sandy loam (Sanders and Gabriel 1985).

Cultural materials at the site consist of a light but extensive surficial scatter of lithic debris and an occasional burned rock. A few moderate concentrations could be discerned in the artifact distributions but in general the materials are fairly diffusely scattered across the area and beyond the right-of-way. No temporally diagnostic artifacts were identified on the site.

Summary of Test Investigations

SWCA's investigations of site 41WB621 included the excavation of four backhoe trenches with column samples, seven 10 m^2 surface collection units, and site mapping with point plots of formal artifacts. Surface investigation and trenches revealed predominantly shallow soils with surface gravels consistent with upland exposures. An area of greater deposition was located along the western edge of the right-of-way within the site boundary. No features were observed within any of the trenches or on the surface of the site. Due to the lack of observed diagnostics, surface collection units were placed in locations of observed informal tools and artifact concentrations located around the site in order to quantify general artifact distribution.

Table 3.13. 41WB621 Testing Recovery

Artifact Category	Quantity	Description
Debitage	57	
Features	0	
Cores	7	
Bifaces	1	Crude Biface
Informal Tools	1	Utilized Flake

Natural Stratigraphy and Geomorphology

Site 41WB621 contains predominantly lag gravels covering a relatively flat upland landform. Trench excavations and surface reconnaissance revealed upland exposures along the eastern portion of the site leading into westward upland gravelly slopes which comprised the vast majority of the site. No distinctive strata were identified in the isolated pockets of fine sediment aggradation (see discussion of adjacent site 41WB622 sediments for description).

Archaeological Findings

No features could be clearly defined. As noted, a few clusters of reduction debris were noted, but these lacked sufficiently clear boundaries or integrity to allow definition of discrete activity areas. For the most part, the materials seemed to be vaguely overlapping scatters on a stable, repetitively occupied surface.

Artifacts were recovered predominantly from surface collection units with only one informal tool (bifacial core) collected from outside a surface collection

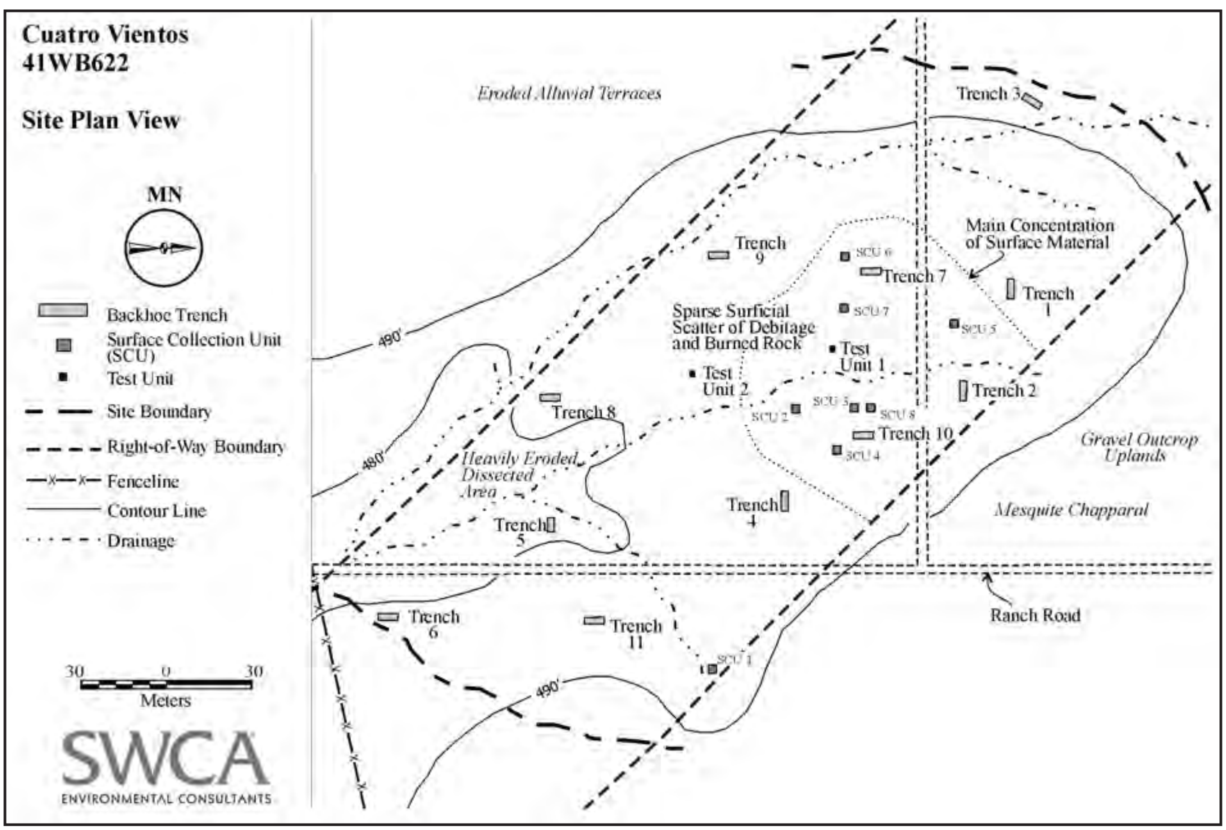


Figure 3.10. Site map of 41WB622.

Figure 3.11. Excavation of a column sample along a trench in 41WB622, showing typical soil profile.

unit. Artifacts recovered from the surface collection units include 57 pieces of debitage, seven cores, one biface, and one utilized flake (Table 3.13). The amount of artifacts recovered from the individual surface collection units ranged from two to 20 artifacts.

Site 41WB622

Introduction

Site 41WB622 is an open campsite and lithic procurement area situated on an upland interfluve approximately 1.4 km south of San Idelfonso Creek. Unnamed tributaries to San Idelfonso Creek and the Rio Grande run along the margins of the landform (Figure 3.10). The site is approximately 75 m south of 41WB621 with an area of dense brush between the two sites. The site extends approximately 250 m north-south by 210 m east-west.

The site is set along the dendritic headwaters of an ephemeral southwest flowing drainage. Shallow alluvial sediments are located along the dissected channels. Upland lag gravels, eroding from the Tertiary Laredo Formation that outcrops on the northern and eastern sides of the site, form a thin and intermittent veneer in some areas. Site soils are Copita fine loams. In most areas, the sediments are less than 1 m in depth and overlie degrading bedrock that includes high concentrations of gypsum. The eastern margin of the site is covered with lag gravels eroding downslope from uplands beyond the project area. Vegetation is a semi-open

Table 3.14. 41WB622 Surface Collection Recovery

Site	Surface Collection Unit #	Rationale for Placement	Recovery	Notes
41WB622	1	Arbitrary/random placement in eastern portion of the site to collect data on eroded area around Biface	Core (2)	Site, circumscribed by heavily eroded landscape, is arbitrarily divided into central site area and eroded margins. SCUs 1, 3, and 4 were randomly placed within these arbitrary divisions, as specified.
	2	Undiagnostic Biface location	Biface (1)	
	3	Arbitrary/random placement in central part of site within main site area	Debitage (32), Informal Tool (2)	
	4	Arbitrary/random placement in gravel outcrop in central portion of site	Debitage (14), Informal Tool (2)	
	5	Location of Projectile Point Tip	Debitage (3), Biface (4), Informal Tool (1)	
	6	Location of Unifacial Scraper	Debitage (9), Informal Tool (1)	
	7	Undiagnostic Biface location	Debitage (16), Biface (1), Informal Tool (1)	
	8	Location of formal Biface (undiagnostic Projectile Point)	Debitage (12), Biface (1)	

mesquite overstory with an understory of yucca, acacia, and prickly pear. Modern disturbances on the site include two ranch roads and a north-south oriented buried utility line. Whereas most sites have evidence of clearing in the recent past, 41WB622 appears to have been unaffected by these activities as indicated by several large, old mesquites.

Test Investigations

Eleven trenches, each with hand-excavated column samples, and two 1-x-1-m units were excavated across the site (Figure 3.11). In addition to the subsurface investigations, an intensive survey of the site and eight surface collection units were conducted to identify and document the distribution of materials, and two surficial burned rock features were documented, cross-sectioned, and fully recovered. The 11 trenches revealed moderately shallow soils throughout the central part of the site, becoming increasingly shallow moving upslope to the north and east. Soils, as discussed below, are silty clays for the most part, overlying degrading bedrock. No buried features or occupational surfaces were identified in any of the trenches, but two surficial features were investigated.

Eight surface collection units recovered seven bifaces, seven informal tools, and two cores. For the most part, the collection units recovered low quantities of debitage, ranging from zero to 32 pieces, minimal counts relative to other sites in the project area (Table 3.14).

Natural Stratigraphy and Geomorphology

Site 41WB622 is located on an upland divide dissected by head-cutting gullies. Sediments derive from slope-wash and localized alluvial deposition. Lag gravels partially cover the site. There is a veneer of historic to modern slope wash on both the concave and convex slopes. For the most part, sediments are shallow clayey to sandy silts. A typical soil profile includes an upper AC stratum of dark yellowish-brown (10YR4/6) very sandy clay silt to a depth of about 20 cm. This overlies a weakly developed Bt horizon comprising brown (7.5YR5/4) very sandy clayey silt to a depth of about 55 cmbs. From 55–100 cm is weakly consolidated, fractured Eocene sandstone bedrock.

Table 3.15. Site 41WB622 Burned Rock Feature

Site	Feature No.	Max Diameter	Temporal Affiliation	Basis for Determination
41WB622	1	150 cm	Indeterminate	No data
41WB622	2	85 cm	Indeterminate	No data

Archaeological Findings

The testing investigations assessed and recovered two features and 140 artifacts, consisting almost exclusively of lithic reduction debris and various formal and informal stone tools.

Features

The features, designated Features 1 and 2, are heavily eroded prehistoric burned rock concentrations (Table 3.15). Both are in surficial contexts.

Feature 1

Feature 1, which was originally identified and plotted during the survey phase (Ringstaff et. al. 2004), was located on the southeastern edge of the site, south of an east-west oriented ranch road that crosses the area. Relocated during the testing, the feature was a surficial scatter of burned rock that appears to retain no clearly intact portions. Though entirely displaced by slopewash erosion, its original location was likely immediately upslope to the southeast. The investigations subdivided the feature into the main component and a subfeature consisting of scattered rocks extending several meters downslope. The main feature consisted of about 20 thermally fractured sandstone rocks in a circa 1-m diameter area. Cross-sectioning revealed no discernible pit or basin, but there appeared to be slight discoloration of the soil from possibly charcoal or ash. All sediment underlying the rocks was collected for pollen, macrobotanical, and radiocarbon dating analyses, but no samples were submitted because of the lack of sealed contexts. The subfeature included about 50 rocks distributed over an approximately 3–5 m plume to the north. At first glance the distribution suggests possible discard patterns, but a more likely interpretation is erosion since the patterning correlates closely with the minor drainage patterns. Based on the findings, the feature was an eroded hearth or small oven displaced by erosion. No formal or expedient tools or ground stone were identified in association.

Feature 2

Feature 2, identified on the surface in the central part of the site, was a diffuse cluster of burned rock measuring about 50 cm in diameter. A few displaced rocks were scattered around the feature. Cross-sectioned, the feature revealed a basin shape about 15–20 cm deep by 50 cm in diameter. Though two small charcoal samples, consisting of small flecks, were collected, the samples were too small to be effective for dating. Additionally, because of the feature's surficial context, no pollen or macrobotanical analyses were conducted on the feature matrix. Overall, the feature is interpreted as small hearth or oven of unknown cultural and temporal affiliation.

Table 3.16. 41WB622 Testing Recovery

Artifact Category	Quantity	Description
Projectile Points	2	1 Tortugas, 1 Carcara
Debitage	119	All stages of reduction debris
Features	2	Heavily eroded hearth-like features
Cores	2	
Bifaces	8	Primarily late-stage use or manufacturing failures
Informal Tools	9	1 Unifacial Scraper, 8 Utilized Flakes
Formal Tools	0	
C-14 Sample	3	Recovered from Features 1 and 2
Bulk Matrix	2	Recovered from Features 1 and 2

Artifacts

Materials recovered from the site include 119 pieces of debitage, two projectile points, eight bifaces (five late stage and two mid stage), one informal unifacial scraper, eight utilized flakes and two cores (Table 3.16). The projectile points include a Tortugas point and a Carcara point. Notably, there are no Nueces tools recovered from the site.

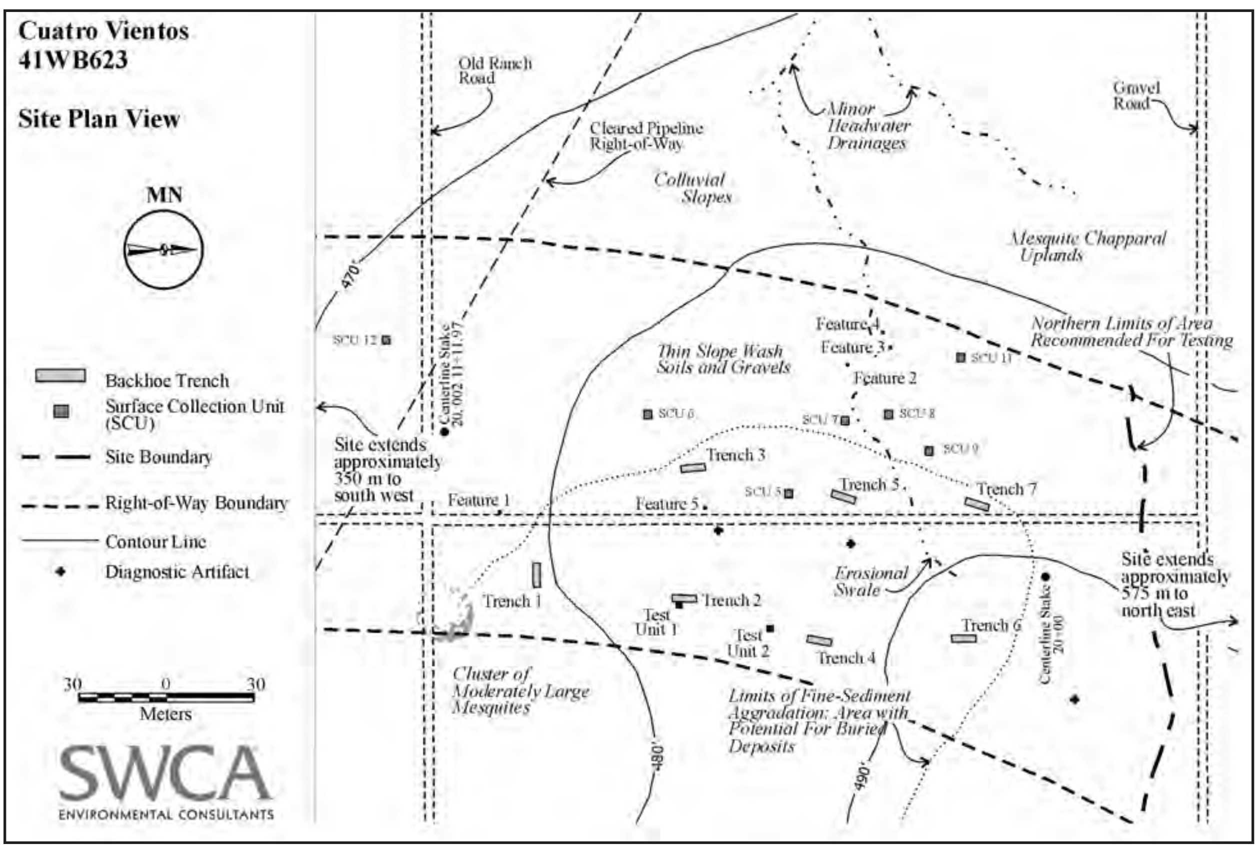


Figure 3.12. Site map of 41WB623.

Site 41WB623

Introduction

Site 41WB623 is an extensive prehistoric lithic procurement locale and open campsite located in rolling uplands along the eastern slopes overlooking a minor tributary to the west. The setting is an interfluvial upland projection overlooking a short drainage that flows into the Rio Grande about 3 km to the west. This linear site is approximately 1.2 km north-south and 200 m wide (Figure 3.12).

Vegetation at the site consists of patches of mesquite interspersed with patches of dense understory scrub brush in some areas, though in general the site is a semi-open setting with good surface visibility. Soils at the site are mapped as Nido-Rock outcrop complex. Nido soils are very shallow, calcareous fine sandy loams on the summit and side slopes of ridges (Sanders and Gabriel 1985:32–33).

The site consists of burned rock features, lithic reduction areas, and a fairly ubiquitous scatter of lithic debris on the site surface. Four features previously identified on the site are eroded burned rock scatters. Three are situated in the west central portion of the site.

Summary of Test Investigations

SWCA's investigations included seven backhoe trenches, column samples along all trenches, two test units, 13 surface collection units, an intensive surface survey, feature investigations, and site mapping to assess site 41WB623. The site, as mentioned, contains shallow fine-sediment deposits primarily on the eastern half of the area recommended for testing, whereas upland gravel outcrops are exposed along the western slopes of the site. Accordingly, subsurface investigations were distributed along and east of the right-of-way centerline for the most part,

Table 3.17. 41WB623 Surface Collection Recovery

Site	Surface Collection Unit #	Rationale for Placement	Recovery	Notes
41WB623	1	Location of diagnostic tool (Nueces Biface)	Debitage (6), Nueces (1)	Site was arbitrarily divided into upper (northern), middle, and lower (southern) slopes. SCUs 7, 11, 12, and 13 were randomly placed within these arbitrary divisions, as specified.
	2	Location of diagnostic Projectile Point (Toyah Point)	Debitage (4), Toyah (1)	
	3	Location of Biface	Debitage (4), Nueces (1)	
	4	Location of Biface	Debitage (15), Refugio (1), Biface (1)	
	5	Location of diagnostic tool (Nueces Biface)	Debitage (12), Nueces (1)	
	6	Location of diagnostic tool (Nueces Biface)	Debitage (30), Nueces (2), Informal Tool (1)	
	7	Arbitrary/random placement in lithic landscape on the upland (northern) portion of the site.	Debitage (71), Informal Tool (1)	
	8	Location of a unifacial tool on upland portion of the site	Debitage (8), Nueces (1)	
	9	Undiagnostic Biface location	Debitage (3), Biface (1), Core (2)	
	10	Location of a late stage Biface with associated lithic debris.	Debitage (59), Biface (1)	
	11	Arbitrary/random placement in lithic landscape on northern portion of the site	Debitage (141), Biface (2)	
	12	Arbitrary/random placement in lithic landscape on southern portion of the site	Debitage (14), Informal Tool (1), Core (1)	
	13	Arbitrary/random placement in lithic landscape on midslopes	Debitage (69)	

and surface collection units were more commonly utilized along the western side. A series of seven backhoe trenches were systematically excavated across the portion of the site with a potential for buried deposits. No features or occupational surfaces were identified in any of the trenches.

Thirteen surface collection units were placed on the site surface to recover artifacts associated with formal or diagnostic tools. The collections included a Toyah arrow point, one Refugio projectile point, six Nueces tools, five bifaces, three informal tools, and three cores. For the most part, the collection units recovered debitage, which ranged from three to 141 pieces per unit, in relatively low quantities compared to other sites in the project area (Table 3.17).

An intensive survey of the site in formal 5-m transects was conducted to assess the quantity and distribution of the site's assemblage. Compared to the five formal artifacts identified in the previous survey phase, which included four Nueces tools and a dart point, the intensive survey recovered 42 tools, which include points, Nueces tools, bifaces, unifaces, utilized flakes, and groundstone. The survey revealed a few lithic reduction areas, but few intact features.

Table 3.18. Site 41WB623 Burned Rock Features

Site	Feature No.	Max Diameter	Temporal Affiliation	Basis for Determination
41WB623	1	150 cm	Indeterminate	No data
41WB623	2	95 cm	Indeterminate	No data

Natural Stratigraphy and Geomorphology

Site 41WB623 is located on an upland divide dissected by headcutting gullies. Sediments derive from slope-wash and localized alluvial deposition. Lag gravels partially cover the site. For the most part sediments are shallow clayey to sandy silts, very similar to the profile on 41WB622. The chronology of the deposits is poorly defined because of the lack of continuous strata associated with chronological data. However, the diagnostic materials indicate middle to late Holocene age. As with most of the project area, a veneer of modern sediments is found on slopes.

Recovered Materials

The testing investigations assessed and recovered six burned rock features and 529 artifacts, consisting of lithic reduction debris and various formal and informal stone tools.

Features

The features, designated Features 1 through 6, are all surficial deposits that include heavily eroded prehistoric burned rock concentrations and a lithic reduction area (Table 3.18). Features 1, 2, and 3, which was originally identified and plotted during the survey phase (Ringstaff et. al. 2004), were similar small burned rock concentrations clustered along the western edge of the right-of-way in a heavily slope-washed area.

Features 1, 2, and 3

Feature 1 measured approximately 150 cm in diameter and consisted of about 20–30 clearly burned rock interspersed with lag gravels eroding from upslope. The feature boundaries and original morphology were obscured by re-deposition to some extent. Feature 2 is similar in composition and context to Feature 1 but retained slightly more integrity. The feature comprised about 35 burned rocks, mainly of quartzite, chert, and sandstone, in an 80-cm diameter cluster on an eroded surface. The soils at the feature are several centimeters thick overlying bedrock, which outcrops several meters upslope from the feature. Lacking a potential for a subsurface component and no evident charcoal, the feature was documented but not further cross-sectioned or excavated.

Feature 3 was a more substantial and intact burned rock cluster about 10 m northwest of Feature 2 on the eroded site surface. Consisting of about 70–80 burned rock in a vaguely ovate configuration measuring about 90-x-60 cm, the feature rocks were fairly tightly clustered. For the most part, the feature was a one-rock-thick layer rather than stacked. Cross-sectioning revealed no charcoal or stained sediments, though a few rocks were darkened on the bottoms suggesting in situ provenience. The feature is interpreted as a small hearth, partially intact, but partially eroded.

Feature 4

Feature 4, also a burned rock feature on the site surface near the previously discussed features, was more diffusely scattered. The feature consisted of about 30 burned rocks in a vaguely circular arrangement within a 1-m^2 area. Cross-sectioning revealed no subsurface expression such as a basin or pit and no carbon. In the final analysis, it was difficult to ascertain whether the feature was primarily the effect of erosion or cultural activity.

Feature 5

Feature 5 was a small lithic reduction area consisting of about 50 flakes of a similar tan chert concentrated in an approximately 5-m^2 area. The feature was one of the few discrete lithic reduction areas on the site. The debitage represents late stage biface reduction on the site and was collected in its entirety.

Feature 6

Feature 6 was a surficial scatter of burned rock that was partially displaced by slopewash erosion, but contained some intact aspects as evident by a small area of charcoal-stained sediments. Consisting of about 40 burned rocks in a 1-m^2 area, the feature is more of a clear cluster than Feature 4. Nevertheless, the feature's original morphology could not be clearly reconstructed, and an undefined amount of the original burned rock and fine-sediment matrix have eroded away. Cross-sectioning revealed no discernible pit or basin, but there appeared to be slight discoloration of the soil possibly from charcoal or ash. All sediment underlying the rocks was collected for pollen, macrobotanical, and radiocarbon dating analyses. Based on the findings, the feature is an eroded hearth or small oven displaced by erosion.

Artifacts

Materials recovered from the site included 483 pieces of debitage, one Toyah arrow point, one Refugio projectile point, two untyped projectile points, 12 Nueces tools, 19 bifaces (three early stage, six mid stage, nine late stage), two unifaces, four utilized flakes, one mano and four cores(Table 3.19). A majority of the artifacts recovered came from the surface collection units (436 pieces of debitage). The arrow point is a Toyah point dating to the Late Prehistoric period.

Table 3.19. 41WB623 Testing Recovery

Artifact Category	Quantity	Description
Projectile Points	4	1 Toyah, 1 Refugio, 2 Untyped
Debitage	483	All stages of reduction present
Features	6	Small burned rock hearths
Cores	4	Informal core types
Bifaces	19	Further typing may identify numerous dart points
Informal Tools	6	2 Uniface, 4 Utilized Flakes
Formal Tools	12	Nueces tools
Groundstone	1	Mano
Mussel Shell	0	Not applicable
C-14 Sample	0	No C14 was identified
Organic Sample	2	Feature matrix

Evaluation of the "Site" Construct

A review of a map depicting the boundaries of the sites in the Cuatro Vientos project area immediately begs the question of how the boundaries were drawn, by what criteria. Two sites, for example, each almost a kilometer long, are arbitrarily divided by a modern roadway (Figure 3.13). The concern is that site boundaries are utterly arbitrary and unreflective of any archaeological or cultural considerations. As one of the primary objectives of the Cuatro Vientos research design came to be the analysis of the spatial distribution of artifacts and features across the landscape, the value of the "site" as an interpretive unit of analysis was clearly of little utility. So the issue turned to an assessment of what sort of data, within a nearly continuous archaeological landscape, needed to be obtained to be of interpretive value.

The Problem With Sites

In cultural resource management, a site is most often the basic archaeological entity of documentation and analysis, and almost the entire database for the Cuatro Vientos context comprises sites, most of which are multi-component. As defined in the NRHP, a site "is the location of a significant event, prehistoric or historic occupation or activity, or building or structure (whether standing, ruined, or vanished) where the location itself possesses historic, cultural, or archaeological

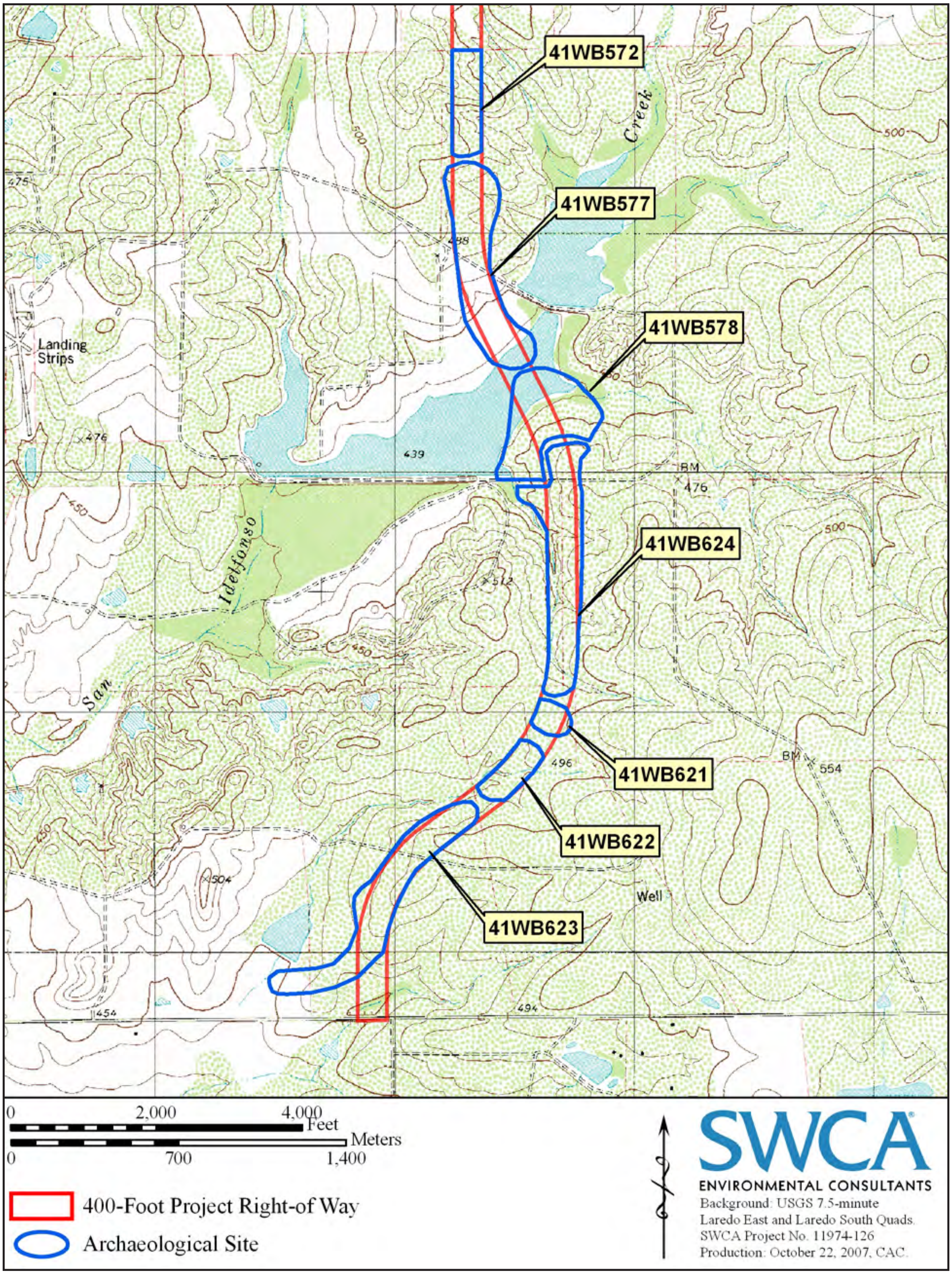


Figure 3.13. Different site boundary types in Cuatro Vientos project area.

value" (National Park Service 1995). However, it seems much of the literature on defining sites and site significance uses a more pragmatic definition of a site as a significant cluster of cultural material, or as Deetz (1967:11) put it "a spatial concentration of material evidence of human activity". Ethnographers and many ethnographic-based models view sites as the collective material remains of a particular group's occupation. and middle range theory

However, it has been noted (e.g. Ebert 1992, McManamon 1984; Sullivan 1992) that the notion of a site may be useful for management purposes, but has little or no utility for addressing research design questions. As Ebert (1992:18) asserts, "sites are not necessary, and in fact are antithetical to, an archaeological approach directed toward understanding the operation of past adaptational systems." Rather than a "site", it is components, assemblages, features, and artifacts that constitute the fundamental data for studying cultural themes. Nevertheless, much of the data that is available is enmeshed in the site concept, and teasing out the data needed to address research issues can be a difficult exercise.

Hierarchy of Site Boundaries

Defining property boundaries, particularly in the case of sites and districts, can be an imprecise science that entails various considerations and has diverse implications. In the Cuatro Vientos data, the site boundaries, as delineated by numerous different researchers over the course of a series of surveys, were based on widely variable criteria, whether arbitrary (such as the limits of the survey area), natural (topographic breaks for example), or archaeological (the limits of cultural materials). While the justification and criteria for any given site boundary is often difficult to discern, for management purposes it was necessary to address each site as previously defined.

"Site" Abandonment

In the analysis of the Cuatro Vientos data, the site construct has largely been tossed out in favor of individual object data (i.e., point plotted data on artifacts and features) (Figure 3.14). Ringstaff et all. (2004) used a dual approach of defining sites while meticulously point plotting most aspects of the archaeological record with a sub-meter accuracy GPS. Their data, consequently, was much more effective, and SWCA adopted a similar strategy during testing. While this chapter presented a discussion of each site, the subsequent chapters deal primarily with the relationships among the individually documented data. Nevertheless, on a regional basis, the data is presented in a site format and consequently broader comparisons rely on the site construct.

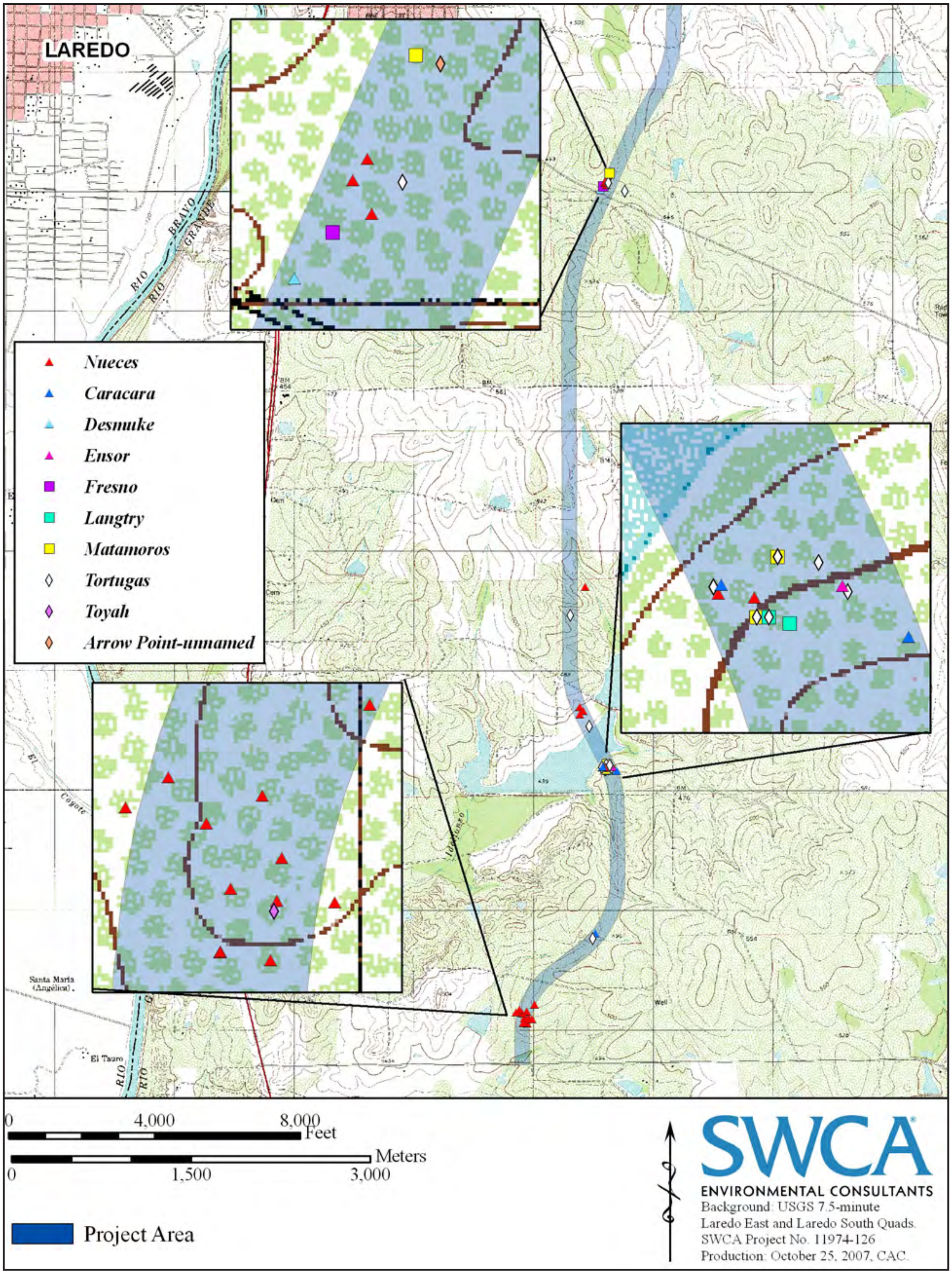


Figure 3.14. Point plotted Cuatro Vientos data.

Chapter 4

Time - Distribution of Temporal Components

Introduction

In general, issues regarding time, notably discerning chronological ordering of archaeological materials, is often cited as among the most pervasive obstacles, as well as one of the largest theoretical issues in addressing south Texas prehistory. Integral to the problem is the very common lack of spatial separation of cultural temporal units within a site, either vertically or horizontally. The south Texas record is quite often an archaeological landscape of undifferentiated and intermixed surface debris deposited by repetitive occupations over long periods of time. Associations are obscure or entirely lacking; time is collapsed on a single surface; materials were continually reworked and reconfigured through successive occupations. The problem affects much more than the broad efforts to construct regional culture chronology and culture history, the ubiquitous compression of time undermines very basic inferences of behavior at the microlevel, such as in small activity areas. For the most part these problems were common in the Cautro Vientos data, though a few areas contained isolable features or activity areas that could be assigned to a particular temporal period. The Cuatro Vientos temporal data is discussed here and addressed in light of these problems.

Cuatro Vientos Chronological Data

The available data from the project area consists of a total of five radiocarbon dates and 32 temporally diagnostic artifacts as the main sources of chronological information. However, the temporal ranges of several artifact styles are poorly defined. Nevertheless, the data provide indications of intermittent cultural occupations from roughly 4,150 B.P. to possibly early historic times.

Radiocarbon Assays

Five radiometric samples were dated, all from features in buried contexts that ranged from 10–115 cmbs (Table 4.1). While each sample contained relatively abundant wood charcoal, it was so intricately embedded in the matrix that it could not be separated out. Consequently, all samples were bulk feature matrix, or “organic sediments” as described by Beta Analytic, who ran the samples.

Three dates from site 41WB441, situated in an upland context, were obtained from shallowly buried features. From Feature 1, a date of 2,320 B.P. indicates the hearth was utilized around the transition from Middle to Late Archaic, which is typically right around the time of Tortugas points. Two dates were obtained

Table 4.1. Preliminary Radiocarbon Data from Testing and Data Recovery

Cultural Component	Site #	Beta #	Elevation (cmbs)	Context	Measured ^{14}C(BP)	$^{13}C/^{12}C$ Ratio	Conventional ^{14}C (BP)	2-Sigma Calibrated Age Estimate	Dated Material
Late Middle Archaic	41WB441	222162	30–40	Feature 1	2260 ± 40	-21.4 o/oo	2320 ± 40	B.C. 410–360 (2,360–2,320 B.P.)	Organic sediment
Historic or Protohistoric	41WB441	222163	10	Feature 2	390 ± 40	-21.7 o/oo	390 ± 40	A.D. 1430–1530 (520–420 B.P.) and A.D. 1550–1630 (400–320 B.P.)	Organic sediment
Historic or Protohistoric	41WB441	222164	10	Feature 3	470 ± 40	-27.2 o/oo	430 ± 40	A.D. 1420–1510 (530–440 B.P.) and A.D. 1600–1620 (350–330 B.P.)	Organic sediment
Late Archaic	41WB577	222165	42	Feature 6	1610 ± 40	-21.3 o/oo	1670 ± 40	A.D. 260–440 (1,690–1,510 B.P.)	Organic sediment
Early Middle Archaic	41WB578	222166	115	Feature 2	4080 ± 40	-20.7 o/oo	4150 ± 40	B.C. 2890–2580 (4,840–4,520 B.P.)	Organic sediment

from Features 2 and 3, which are actually associated aspects of a single feature, a hearth and associated ash pile, respectively. Feature 2 yielded an age of 390 B.P., and the ash pile dated to 430 B.P. These dates would indicate a Protohistoric occupation or even early Historic, though there is likely good cause to consider this feature historic, maybe a campfire associated with the nearby ranch. The old wood problem would suggest a later occupational date than the assays indicate. In New Mexico and Arizona sites where dendrochronology and radiocarbon dates can be directly compared, radiocarbon dates are typically 150–300 years earlier than the actual occupation (Dykeman et al. 2002:148). In long-lived species such as juniper, oak, and mesquite found on site 41WB441, the heartwood can be hundreds of years older than the wood's use in a fire. This old wood problem, coupled with the lack of associated prehistoric or aboriginal archaeological remains in or around Features 2 and 3, imposes some doubt on a literal reading of the radiocarbon dates and the implication of a Protohistoric aboriginal occupation on the site.

From 41WB577, a date of 1,670 B.P. was obtained from organic sediments among a relatively loose scatter of hearth rocks situated about 42–50 cmbs. The date indicates a Transitional Archaic occupation.

Finally, an Early Middle Archaic date of 4,150 B.P. was obtained from Feature 2 sediments on 41WB578. This feature was situated at 115 cmbs in one of the ew aggradational settings in the Cuatro Vientos project area, the terraces of San Idelfonso Creek.

Cultural and Chronological Affiliations of Artifact Styles

Artifact styles, particularly formal tools such as projectile points and certain types of scrapers, are the most common chronological "index fossils" available in Webb County. Referring back to the discussion of chronology and diagnostic artifacts in Chapter 2, the chronology of the Lower Rio Grande Plains is divided as shown in Table 4.2.

Eight temporally diagnostic projectile point styles were recovered from the Cuatro Vientos sites. Langtry, often associated with the Lower Pecos region, is the earliest of the point types, dating to the early Middle Archaic. Tortugas points, which are considered late Middle Archaic, are the most common points. Their chronological affiliation is subject to a degree of typological uncertainty since they grade into the Matamoros type (see Mahoney et al. 2002). A lone Ensor point, which has a widespread distribution, is a distinctive chronological indicator of the Transitional Archaic. In addition to the dart points, arrow point styles include Toyah, Caracara, and Fresno.

The list also includes Nueces tools, which are generally attributed to the Middle to Late Archaic (Turner and Hester 1997) or Middle Archaic (Hester 2004). As discussed in Chapter 2, specific data shows these forms are chronologically associated with the late Middle Archaic. To further explore this chronology, several data queries were utilized to assess the temporal distribution of Nueces tools, which are important in discussions of technological organization and assemblages addressed later in this report.

Table 4.2. Chronological Periods and Diagnostic Artifacts from the Lower Rio Grande Plains

	Early Middle Archaic (4400–3100 B.P.)	Late Middle Archaic (3100–2300 B.P.)	Late Archaic (2300–1850 B.P.)	Transitional Archaic (1850–1200 B.P.)	Late Prehistoric (1200–250 B.P.)
Diagnostic Artifacts	Pedernales	Tortugas	Shumla	Ensor	Starr
	Lange	Abasolo	Marcos	Frio	Perdiz
	Langtry	Carrizo	Montell	Matamoros	Toyah
	Morhiss	Nueces?	Ellis	Catan	Fresno
	Bulverde		Desmuke	Fairland	All Other Arrowpoints
	Clear Fork?		Castroville	Edgewood	Ceramics
	Kinney				

A review of all site data in Webb County yielded tabulated data on other diagnostic artifacts reported from sites with Nueces tools. According to this information, Tables 4.3 and 4.4 suggest a rather close correlation with the Tortugas point, which is estimated to date from about 3,100–2,300 B.P., the late Middle Archaic. Similarly, the spatial distribution of sites yielding Nueces tools is almost identical to the distribution of late Middle Archaic sites. If it is true that the overlap in spatial and temporal distribution among forms is an indication of cultural association (Clark 1957; Willey and Phillips 1958:32), then the data suggest Tortugas and Nueces tools were part of the same tool kit. The chronological data from Choke Canyon, the Loma Sandia Site, as well as the apparent contemporaneity with better-dated Tortugas points, indicates Nueces tools are part of the late Middle Archaic assemblage.

The analysis of the temporal data recovered from the seven Cuatro Vientos sites relies on point plotted data of all diagnostic artifacts and radiometric data, a total of 51 data points (Table 4.5). The data includes 26 projectile points, 21 Nueces tools, and four radiocarbon dates (Features 2 and 3 on site 41WB441 is listed as a single data point), to assess the distribution of occupations across the landscape over time.

The most readily apparent trend in the data is the predominance of late Middle Archaic dates and diagnostic artifacts. Of the 51 temporal indicators, 34, precisely two-thirds (66.67 percent) are from this time period. The second most prominent period is the Late Prehistoric followed by the Transitional Archaic. Least represented is the Early Middle and Late Archaic periods. The information can be used to devise a simple index of archaeological visibility (Table 4.6). According to the number of diagnostics per millenia (duration of the respective chronological periods), the Late Middle Archaic remains clearly the most visible in the archaeological record, with the Late Prehistoric and Transitional Archaic roughly equivalent. Despite the Early Middle Archaic being three times longer than the Late Archaic both are about similarly evident in the chronological data.

The full implications of these trends will need to be considered with multiple other lines of information, but a few general statements can be said about the meaning of these data on archaeological visibiliity. There are two aspects to the problem, post-depositional and depositional. The former includes processes such as widespread erosional episodes that substantially removed portions of the record. Compilations of the central Texas data show significant gaps in the depositional records of almost all drainage basins during at least two

Table 4.3. Co-occurrence of Diagnostic Artifacts Reported on Webb County Sites Containing Nueces Tools

	Tortugas	Abasolo	Matamoros	Catan	Desmuke	Ensor	Langtry	Refugio
# of Sites with Diagnostic Artifacts Co-Occuring with Nueces Tools	26	10	11	12	10	2	1	4
% Co-occurrence of Nueces Tools and Diagnostic Artifacts on 37 Sites with at Least One of Each	70.30%	27.00%	29.70%	32.40%	27.00%	5.40%	2.70%	10.80%
% Co-occurrence of Nueces Tools and Diagnostic Artifacts on All Nueces Bearing Sites (Out of a Total of 41 Sites)	63.40%	24.40%	26.80%	29.30%	24.40%	4.90%	2.40%	9.80%

Table 4.4. Culturo-Temporal Components Identified on 34 Nueces-Bearing Sites that Contained Chronological Indicators

	Early Middle Archaic	Late Middle Archaic	Late Archaic	Transitional Archaic	Late Prehistoric
# of Components Identified with Nueces Tools	2	29	11	17	14
% of Total (34) Sites in Which Temporal Components Could Be Defined	5.90%	85.30%	32.40%	50.00%	41.20%

Table 4.5. Point-Plotted Temporal Data from Cuatro Vientos

Site	Diagnostic Name	Number	Chronological Periods
41WB578	Langtry	2	Early Middle Archaic
41WB578	Feature 20	1	Early Middle Archaic
41WB622	Tortugas	1	Late Middle Archaic
41WB578	Tortugas	4	Late Middle Archaic
41WB578	Nueces	2	Late Middle Archaic
41WB623	Nueces	12	Late Middle Archaic
41WB577	Nueces	3	Late Middle Archaic
41WB577	Tortugas	1	Late Middle Archaic
41WB572	Tortugas	1	Late Middle Archaic
41WB572	Nueces	1	Late Middle Archaic
41WB441	Nueces	3	Late Middle Archaic
41WB441	Tortugas	1	Late Middle Archaic
41WB578	Tortugas	3	Late Middle Archaic
41WB441	Desmuke	1	Late Archaic
41WB441	Feature 1	1	Late Archaic
41WB578	Matamoros	1	Transitional Archaic
41WB441	Matamoros	1	Transitional Archaic
41WB577	Feature	1	Transitional Archaic
41WB578	Matamoros	1	Transitional Archaic
41WB578	Ensor	1	Transitional Archaic
41WB622	Caracara	1	Late Prehistoric
41WB578	Caracara	2	Late Prehistoric
41WB623	Toyah	1	Late Prehistoric
41WB441	Fresno	1	Late Prehistoric
41WB441	Arrow Point-Unnamed	1	Late Prehistoric
41WB441	Feature 2/3	1	Late Prehistoric

Table 4.6. Archaeological Visibility Index-Frequency of Cuatro Vientos Temporal Data Per Millenia

Period	Temporal Duration	Millenia	# of Temporal Diagnostics	Archaeological Visibility Index
Early Middle Archaic	4,400–3,100 B.P.	1.3	3	2.307
Late Middle Archaic	3,100–2,300 B.P.	0.8	34	42.5
Late Archaic	2,300–1,850 B.P.	0.45	1	2.22
Transitional Archaic	1,850–1,200 B.P.	0.65	5	7.79
Late Prehistoric	1,200–250 B.P.	0.95	8	8.42

episodes during the last 5,000–6,000 years (Collins 2004; Johnson and Goode 1994). During these times, many geomorphological studies indicate a degree of truncation by erosion. We are not aware of a similar synthesis of data for far south Texas, but it is plausible these were rather widespread geomorphic conditions. In central Texas, the dating on the two non-depositional periods is still widely debated, but they seem to roughly coincide with the early Middle Archaic and Late Archaic, the two poorly represented periods.

On the other hand, depositional processes, including both cultural and natural factors, may account for the archaeological visibility patterns. While population size is a rather obvious contributor, an equally significant factor is different cultural systems that have widely variable effects on the amount of debris that is discarded. Collector's residential sites, for example are repeatedly occupied for relatively long periods resulting in high archaeological visibility (Binford 1980). Forager's residential sites, more equitably spread across the landscape, are less frequently reoccupied and for shorter duration by smaller groups, which results in lower archaeological visibility. Other cultural factors, such as a decreased importance in the artifact types that are temporally diagnostic, has also been cited as an obscuring factor in drawing inferences from diagnostic artifact data (see for example Miller 2004:231–232 for far western Texas).

These issues will be juxtaposed with various aspects of the archaeological record in an effort to look at the diachronic cultural processes despite the obscuring processes. Ultimately, the depositional and post-depositional processes are probably not entirely mutually exclusive. In other words, the same conditions that lead to erosion also effect the adaptive strategies and population levels, thereby reinforcing the patterns.

Summary and Discussion: The Problem of Time in Cuatro Vientos

In the spring Council of Texas Archeologist meetings in 2007, the focus of papers was "palimpsest" sites and processes. Of all places in the state, the problem is perhaps as relevant in south Texas as anywhere. The debate was structured around ideas Bailey (1983) presented in *Concepts of Time in Quaternary Prehistory*. A few of the salient points are briefly summarized here then applied to one site to illustrate the specific problems in interpretation. Behavior takes place over different time scales from the brief immediacy (from seconds to hours) of particular activities to long-term multi-generational cultural processes (decade, centuries, and beyond). For the most part, different types of explanations are utilized to address the different scales of time. For example, long-term processes are typically interpreted in terms of populations, ecology, economy, social organization, and demographics. Conversely, short-term processes are often analyzed in terms of individual objectives and motivations, specific tasks, and social processes. Bailey describes "hierarchical time" as numerous different scales existing simultaneously in which both short-term and long-term processes act at the same time to effect behavior. The archaeological record is built from the cumulative effects of short-term behaviors and cultural processes taking place over a long time. The overwhelmingly vast majority of approaches to archaeology attempt to isolate and study the various short and long-term processes to distinguish and characterize changing trends and processes in culture and behavior. This requires some means of temporal distinction among the components, at least at some scale, whether activity area, surface, component, stratum, period, or otherwise. The distinction is usually based on spatial separation such as stratigraphy or vertical segregation.

As an example, in the case of 41WB578, significant portions of the site are non-aggrading surfaces with overlapping occupational debris from 4,000 years or more of intermittent occupation. Repetitive occupations on the same surface contributed additional refuse, reconfigured the associations of previous occupations (palimpsest processes), and reused or extracted earlier materials (high-grading). The effect is to collapse the hierarchical components of time so that no distinctions can be made between constituent behaviors and cultural processes, and therefore undermine the applicability of most explanatory approaches (Figure 4.1). These are problems that are trying to either be addressed or circumvented in this study.

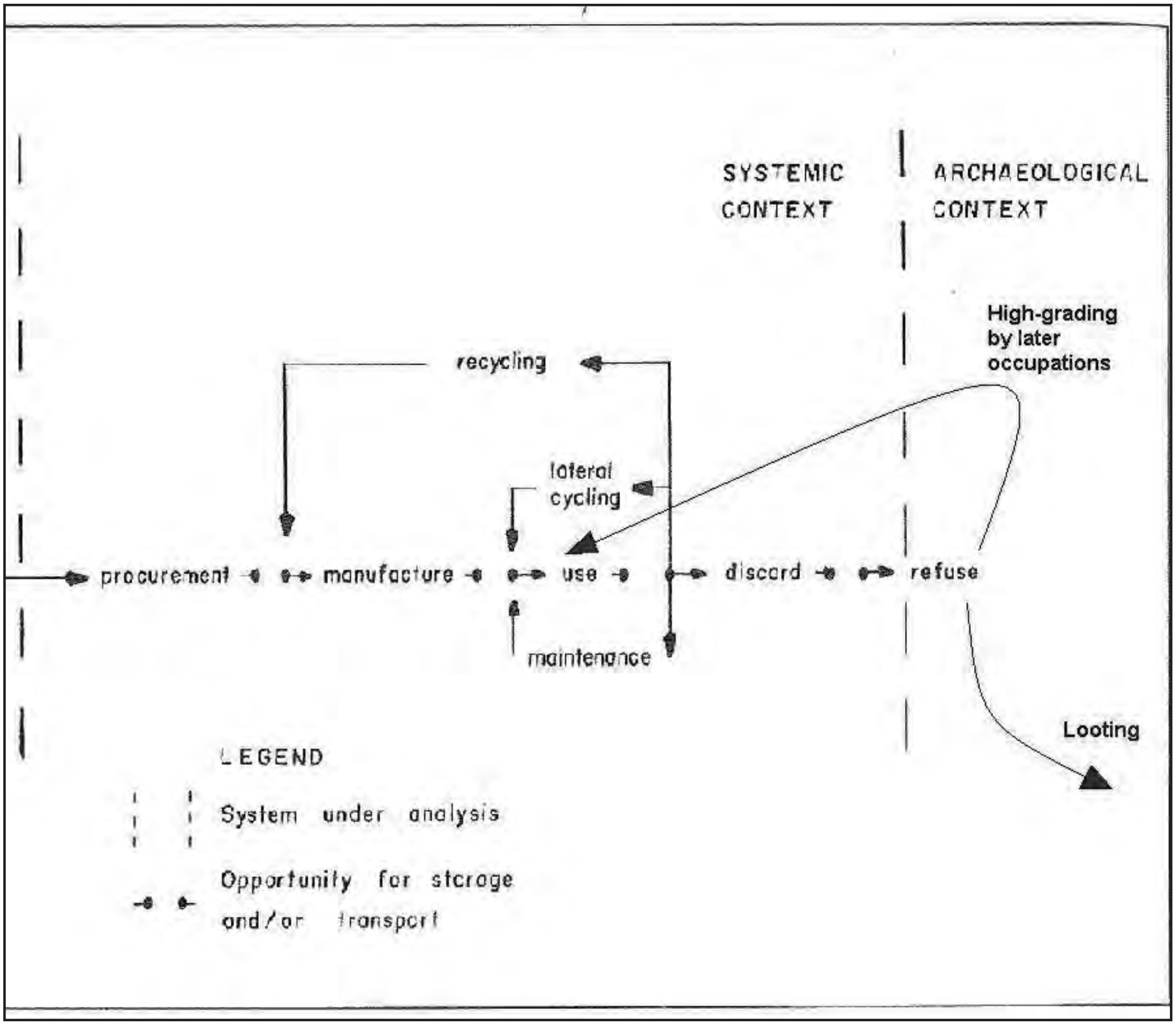


Figure 4.1. Schiffer's (1972) seminal distinction between systemic and archaeological context. The blue lines and text are added to illustrate the flaws in the distinction between the two in south Texas surface sites.

Chapter 5

Form and Function - Analyses of Nueces Tools

A primary concern of archaeological analysis is form and function, and the highly involved relationship between the two aspects. For many material categories, the measurable aspects of form constitute the basis of inferring their functions. As Deetz (1967:83) notes, the identification of shared attributes among formal characteristics contributes to the definition of structural components of archaeological assemblages and societies. The cumulative assortment of functional inferences, including stylistic aspects, allows the reconstruction of various levels of behavior patterns.

Serving as a basis for subsequent interpretations, this chapter and the following Chapter 6 look at variation in the formal characteristics of two archaeological classes, Nueces tools and burned rock features, which are among the few viable datasets recovered from the project area. The inferred functions of these classes further contributes to an understanding of settlement patterns and foraging strategies discussed in the later chapters.

History of Nueces Tools

The Nueces tool, or scraper, was first defined from specimens recovered from the Oulline Site (41LS3) and others in LaSalle County, which borders Webb County to the north (Hester et al. 1969). The tools were defined as:

> …having a distinctive trapezoidal outline. The edges of the specimens are usually straight to convex; the widest side is steeply beveled….. [and] are plano-convex in cross section [Hester et al. 1969:148].

Later interpretations of the tool type include specimens with transverse cross sections varying from biconvex to plano-convex (Mahoney et al. 2002:83). In addition, scrapers with a roughly lunate outline have been included in the Nueces tool type definition (Mahoney et al. 2002; Turner and Hester 1999). Although these tools appear to include a wide range of characteristic attributed to the type, the Nueces scrapers are distinct from other formal scrapers of the region, namely Dimmit scrapers and Olmos bifaces. Dimmit scrapers have a "hump-backed" appearance in a more triangular outline, while Olmos bifaces are small triangular bifaces with straight or slightly convex lateral edges (Mahoney et al 2002). Tools meeting the Nueces description have been found widely throughout the northern portion of south Texas (Turner and Hester 1997). Although attempts have been made at suggesting a sequence of bevel tools spanning temporal periods, others have suggest this area is "….a functional and technological puzzle that will require much research to sort out"(Hester 2004:139).

Nueces Tools – Their form, Distribution, and Cultural Implications

The objective in studying Nueces tools from the Cuatro Vientos sites is to develop a model of technological organization, meaning the spatial and temporal relationships among the manufacture, use, and discard of tools and features in any given cultural system (Andrefsky 1991; Bamforth 1986, 1991; Binford 1979; Kelly 1988, 1992; Nelson 1991; Shott 1989; Torrence 1983). Scrapers similar in form to the Nueces tools are found worldwide, such as tulas from Australia (Figure 5.1), the reduction sequence of which has been the subject of a number of ethnographic and quantitative studies (Gould 1971). These tools are possibly one of the best avenues for addressing technological organization, in part because of its distinctive and measurable reduction sequence that reveals discard patterns relative to use-life. Nueces tools are formal tools that represent a regular design, relatively high labor input in production, and anticipatory use, which are aspects of "personal gear" (Binford 1979:261), as distinct from situational or expedient gear. Formal personal gear is designed for a relatively long use-life, allowing repetitive edge rejuvenation to extend use-life.

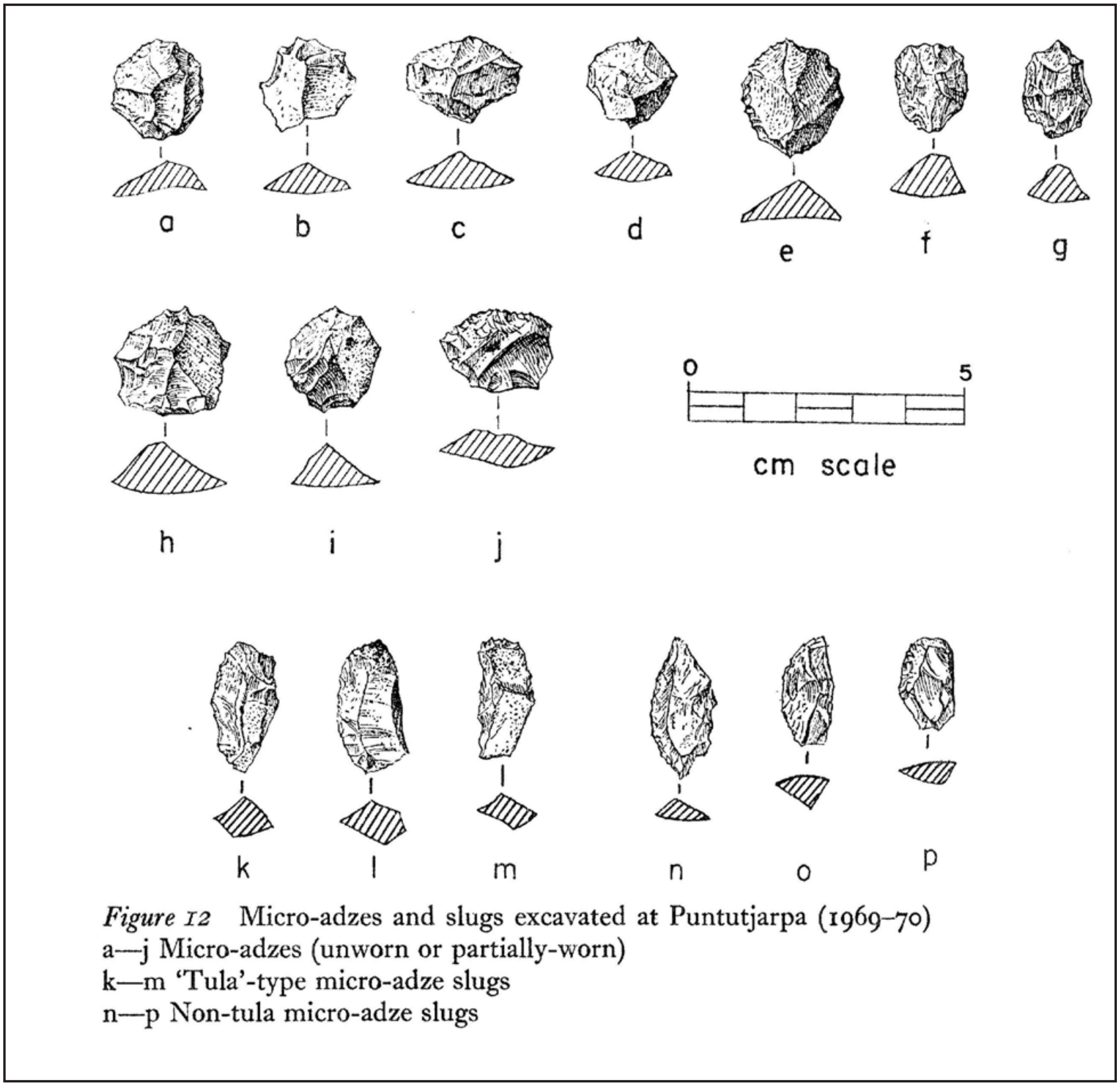


Figure 5.1. Reduction sequence of Australian scrapers that, in the final stage, resemble Nueces tools (From Gould 1971).

Cuatro Vientos Nueces Tools

A total of 21 Nueces tools were recovered from five of the seven Cuatro Vientos sites (Figure 5.2; Table 5.1). None were found on sites 41WB621 or 41WB622. The majority (N=12, 57 percent) came from a single site, 41WB623. Three tools were recovered from each of two sites, 41WB441 and 41WB577, and two or less were found on the remaining three sites. The implications of the spatial distribution will be discussed in more detail below. From the five sites, all tools were found in surficial contexts.

Technologically, the tools are distally-beveled, trapezoidal or lunate-shaped, and have a plano-convex cross-section as is typically of the form (Turner and Hester 1993). Most (n=11, 52 percent) are unifacially made on thick core flakes, which often retain some amount of cortex. Five tools (24 percent) are "quasi-bifacial", meaning they are primarily unifacially reduced, though having a few incidental flakes removed from the ventral surface. Finally,

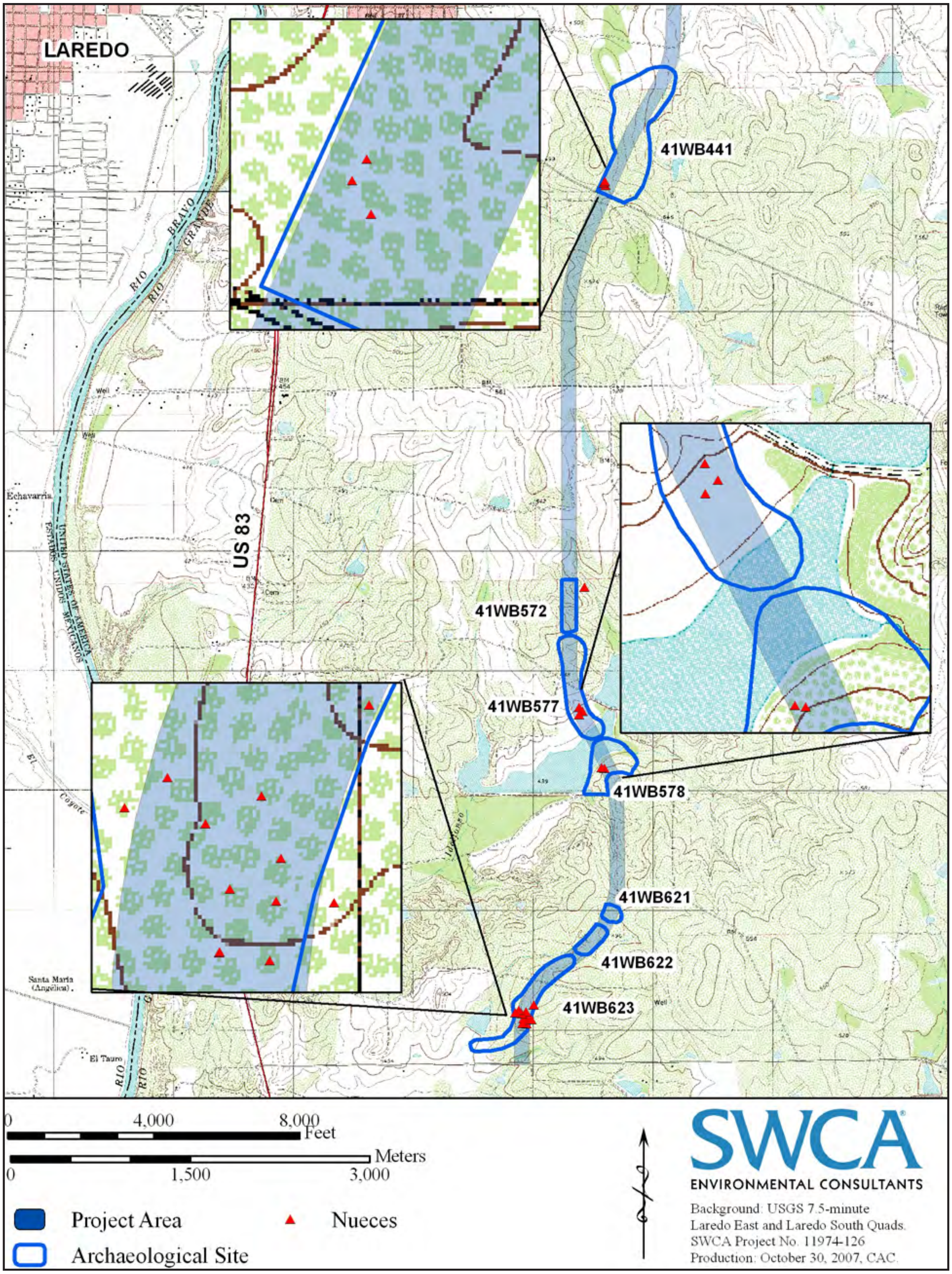


Figure 5.2. Distribution of Nueces tools in Cuatro Vientos site.

Table 5.1. Cuatro Vientos Nueces Tool Measurements

Nueces Tool	Site	Weight (grams)	Length (mm)	Width (mm)	Thickness (mm)	Ht of Retouch Scars (mm)	Distal Edge Angle (degrees)*			
							Angle 1	Angle 2	Angle 3	Average
441-21.1	41WB441	24	37.40	49.79	14.16	13.25	48	54	37	46.33
441-22.1	41WB441	17	29.99	54.14	10.93	9.50	58	67	54	59.67
441-14	41WB441	37	48.35	47.48	13.10	9.10	63	61	81	68.33
572-17	41WB572	54	58.70	48.06	19.65	4.03	54	52	39	48.33
577-36	41WB577	22	42.41	39.76	13.84	6.54	62	68	52	60.67
577-41	41WB577	29	36.12	52.02	12.38	11.49	65	75	68	69.33
577-34	41WB577	41	46.62	53.89	18.44	10.59	39	53	50	47.33
578-42	41WB578	17	28.43	49.30	11.59	10.22	75	70	62	69.00
578-342	41WB578	8	28.04	37.99	8.28	8.28	66	71	68	68.33
623-24	41WB623	13	25.75	51.25	9.73	9.58	64	78	60	67.33
623-12	41WB623	44	48.35	52.79	19.09	6.13	53	51	53	52.33
623-58	41WB623	16	31.21	47.23	13.62	11.10	65	69	67	67.00
623-25	41WB623	19	30.84	53.63	12.64	12.06	62	65	62	63.00
623-28	41WB623	16	33.43	47.43	10.03	8.38	62	72	68	67.33
623-42	41WB623	13	26.00	50.58	9.95	9.61	73	85	71	76.33
623-21	41WB623	26	36.23	54.28	13.96	13.77	76	75	75	75.33
623-46	41WB623	22	34.52	53.91	11.01	10.24	63	77	71	70.33
623-38	41WB623	12	33.01	42.61	9.12	8.11	47	56	61	54.67
623-54	41WB623	9	22.56	42.54	10.93	9.40	73	82	78	77.67
623-49	41WB623	23	44.84	37.48	12.96	5.56	59	58	54	57.00
623-16	41WB623	7	25.56	34.32	9.29	7.61	69	73	64	68.67
Mean		22.33	35.64	47.64	12.60	9.53	61.71	67.24	61.67	63.54
Standard Error		2.74	2.05	1.35	0.70	0.53	2.08	2.22	2.53	2.06
Median		19	33.43	49.3	12.38	9.58	63	69	62	67.33
Standard Deviation		12.54	9.41	6.18	3.21	2.44	9.52	10.19	11.61	9.45
Coefficient of Variation		0.56	0.26	0.13	0.25	0.26	0.15	0.15	0.19	0.15
Sample Variance		157.23	88.52	38.15	10.30	5.96	90.71	103.79	134.73	89.27
Kurtosis		0.74	0.15	-0.47	0.45	0.17	0.32	-1.01	-0.02	-0.74
Skewness		1.11	0.83	-0.82	1.00	-0.41	-0.64	-0.17	-0.50	-0.50
Range		47	36.14	19.96	11.37	9.74	37	34	44	31.33
Minimum		7	22.56	34.32	8.28	4.03	39	51	37	46.33
Maximum		54	58.7	54.28	19.65	13.77	76	85	81	77.67
Sum		469	748.36	1000.48	264.7	200.03	1296	1412	1295	1334.33
Count		21	21	21	21	21	21	21	21	21

* Angles 1, 2, and 3 are measurements of distal scraper edge on left, center, and right, respectively, from perspective of dorsal side facing up.

five tools (24 percent) are clearly bifacial and are among the most formal of the collection in terms of the symmetry in their outline and cross-section. Conceivably, however, the bifacial forms were simply made on broken bifaces of a suitable size.

With the exception of a Nueces tool made of agate, raw materials are entirely fine-grained cherts that are consistent with locally available materials found almost throughout the project area. These range in color from tan to white to dark olive and brown. The agate piece is a dark brown with white and bluish crystaline veins. The selection of high-grade cherts seems to be a distinction from larger gouges, such as Clear Fork tools that are often made of coarser grained materials.

Six attributes were measured on the Nueces tools as shown on Table 5.1. These attributes included: weight, length, width, thickness, height of retouch, and distal edge angles. Three edge angles from the distal scraper edge were measured to calculate an average for the overall utilized edge angle. Once this data was obtained, the descriptive statistics for each attribute were calculated. An initial observation revealed quite a bit of variation with regards to standard deviation within some of the attributes.

As an initial review of the data, variation provides insights into the nature of the population. If certain variables show substantial variation, but others remain relatively constant, addressing the sources of such diversity, or the lack thereof, constitutes a viable research avenue. Assuming all stages of reduction are present, if diversity within the group of Nueces tools derives from the use-life of the tool form, then certain variables, such as length, weight, edge-angle, should exhibit greater variation than other aspects, such as width. Edge angles would expectedly show greater variation under the presumption that angles increase over the life of the tool. Conversely, thickness should change little if any since the maximum thickness of a scraper defines its maximum utility (Kuhn 1990).

In light of these expectations, some attributes revealed quite a bit of variation, while others remained fairly consistent. Weight revealed the highest coefficient of variation. Thickness, averaging 12.6 mm, length, an average of 35.64 mm, and height of retouch, averaging 2.44 mm, showed a moderate amount of variation. The most consistent attributes were width, which averaged 47.64 mm, and distal edge angles, with an average of 63.54 degrees. For the most part, these data are consistent with the effect of modifications through the use-life of a tool, namely attrition of the distal end. As a population, resharpening and use wear decreases tool length and weight, and increases the invasiveness of retouch scars. Width variation, contingent upon the shape of the original tool form, is not directly effected by distal resharpening. However, in forms with sharply contracting proximal ends, width will be directly correlated with reduction. The constancy of edge angle runs counter to the assumption that edge angle increases through the reduction sequence. Additionally, thickness shows more variation than expected according to our initial assumptions. However, these are preliminary observations that are better addressed through analyses of *correlations* among attributes as discussed in the following section.

Form and Reduction Stage

In all likelihood, the distinctive lunate or trapezoidal form of Nueces tools is the effect of retouch, and the earliest and latest stages of reduction often go unrecognized. The effects of reduction on the classification of tools has long been studied and noted as a primary factor in assemblage variability (Dibble 1987; Flenniken and Wilke 1989; Jelinek 1976; Schiffer and Skibo 1997). Nueces tools are among the most problematical in this regard since its morphology changes drastically through its use life, though function remains the same. Both early and late stage forms bear little resemblance to the commonly recognized form.

To address technological organization, it is necessary to determine which quantifiable aspects of Nueces tools are indicators of differing stages of reduction. In a study of Paleolithic scraper morphology, Dibble (1987:114) identified a direct correlation between edge angle and variables that reflect degree of reduction (Figure 5.3). In other words, edge angle increases over life of the tool. This trend is likely true of scrapers in general and Nueces tools in particular.

Within the Cuatro Vientos collection the range of forms is apparent, extremes of variation that are largely the result of reduction sequence (Figure 5.4). The primary means of verifying the relationship between form and stage of reduction lies in the relationship of a number of different variables, notably Kuhn's (1990) Geometric Index of Unifacial Reduction and other simple ratios. Table 5.2 shows these various ratios for the Cuatro Vientos Nueces tools.

Assessing Stage of Reduction: Correlations Among Variables

A series of correlations among variables are the best means of assessing the degree or stage of reduction.

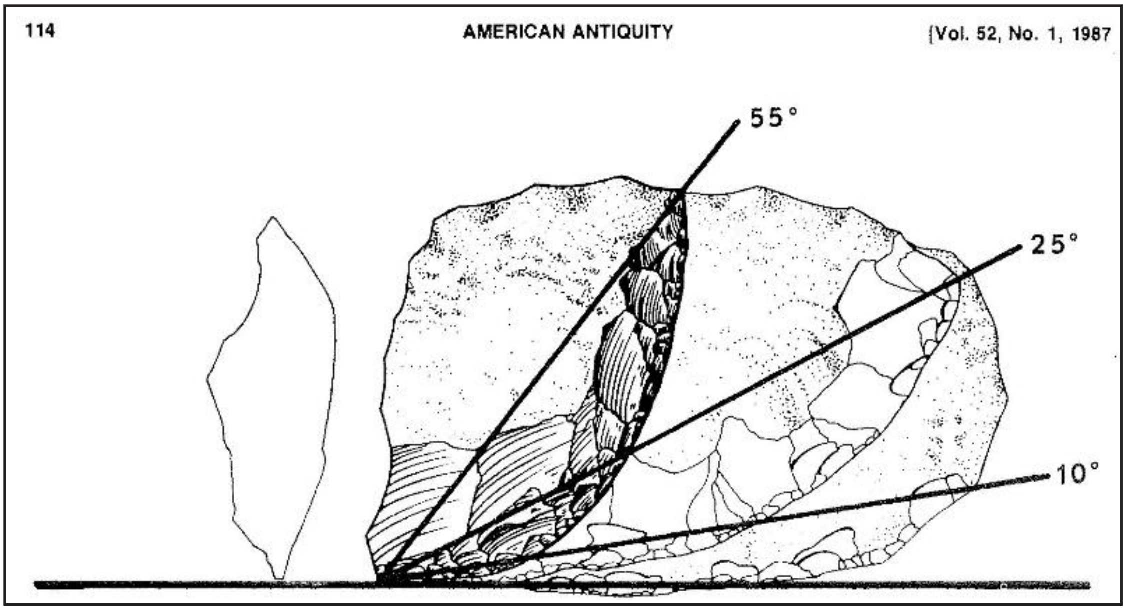


Figure 5.3. Dibble's analysis of Paleolithic scraper morphology showing a direct correlation between edge angle and variables that reflect degree of reduction – edge angle increases over life of tool. Figure adapted from Dibble 1987:114.

Figure 5.4. Possible reduction sequence of Nueces tools from 41WB623. From left to right, an early stage tool, mid-stage, and exhausted piece. Edge angles increase from approximately 35° to 65° to 85°, respectively from left to right.

Table 5.2. Ratios Among Attributes

Nueces Tool	Relative Thickness (T/W)	Kuhn's Reduction index	Length: Thickness	Length: Width	Thickness: angle	Width: Angle
572-17	0.41	0.21	2.99	1.22	0.41	0.99
623-12	0.36	0.32	2.53	0.92	0.36	1.01
623-49	0.35	0.43	3.46	1.20	0.23	0.66
577-36	0.35	0.47	3.06	1.07	0.23	0.66
577-34	0.34	0.57	2.53	0.87	0.39	1.14
441-14	0.28	0.69	3.69	1.02	0.19	0.69
623-58	0.29	0.82	2.29	0.66	0.20	0.71
623-16	0.27	0.82	2.75	0.74	0.14	0.50
623-28	0.21	0.84	3.33	0.70	0.15	0.70
623-54	0.26	0.86	2.06	0.53	0.14	0.55
441-22.1	0.20	0.87	2.74	0.55	0.18	0.91
578-42	0.24	0.88	2.45	0.58	0.17	0.71
623-38	0.21	0.89	3.62	0.77	0.17	0.78
577-41	0.24	0.93	2.92	0.69	0.18	0.75
623-46	0.20	0.93	3.14	0.64	0.16	0.77
441-21.1	0.28	0.94	2.64	0.75	0.31	1.07
623-25	0.24	0.95	2.44	0.58	0.20	0.85
623-42	0.20	0.97	2.61	0.51	0.13	0.66
623-24	0.19	0.98	2.65	0.50	0.14	0.76
623-21	0.26	0.99	2.60	0.67	0.19	0.72
578-342	0.22	1.00	3.39	0.74	0.12	0.56
Mean	*0.27*	*0.80*	*2.85*	*0.76*	*0.21*	*0.77*
Standard Error	*0.01*	*0.05*	*0.10*	*0.05*	*0.02*	*0.04*
Median	*0.26*	*0.87*	*2.74*	*0.70*	*0.18*	*0.72*
Standard Deviation	*0.06*	*0.23*	*0.45*	*0.22*	*0.09*	*0.17*
Sample Variance	*0.00*	*0.05*	*0.20*	*0.05*	*0.01*	*0.03*
Kurtosis	*-0.32*	*1.71*	*-0.69*	*0.00*	*0.89*	*-0.07*
Skewness	*0.80*	*-1.61*	*0.40*	*0.93*	*1.40*	*0.68*
Range	*0.22*	*0.80*	*1.63*	*0.72*	*0.29*	*0.64*
Minimum	*0.19*	*0.21*	*2.06*	*0.50*	*0.12*	*0.50*
Maximum	*0.41*	*1.00*	*3.69*	*1.22*	*0.41*	*1.14*
Sum	*5.59*	*16.75*	*59.89*	*15.91*	*4.38*	*16.15*
Count	*21*	*21*	*21*	*21*	*21*	*21*

The various attributes provide cumulative evidence supporting inferences on technological organization.

Kuhn's Index of Reduction

Kuhn (1990) developed a rather simple index to determine the reduction intensity in unifacial scrapers. The ratio between the height of retouch (t) and the maximum thickness (T) has been found to be an effective measure of tool maintenance and rejuvenation (Figure 5.5). Through the life of a tool, the retouch should become gradually closer to the maximum flake thickness, converging at a 1:1 ratio at which point the tool is theoretically exhausted. High intensity of reuse is commonly seen as a measure of curated technology (Binford 1979; Kuhn 1989) and other aspects of technological organization and raw material economy.

Application of Kuhn's ratio to the Cuatro Vientos data identified the entire range from early stage to the highest possible degree of exhaustion. Fifteen (71 percent) of the tools were discarded with an index of greater than .80, or 80 percent representing specimens that are theoretically late stage to completely exhausted (Figures 5.6–5.8). Six of the tools were less than 70 percent exhausted, ranging from .21 to .69, and are considered mid to early stage discards (Figure 5.9).

Kuhn's index strongly correlates with length and edge angle. As the index increases, so does the edge angle while length decreases. Rather unexpectedly,

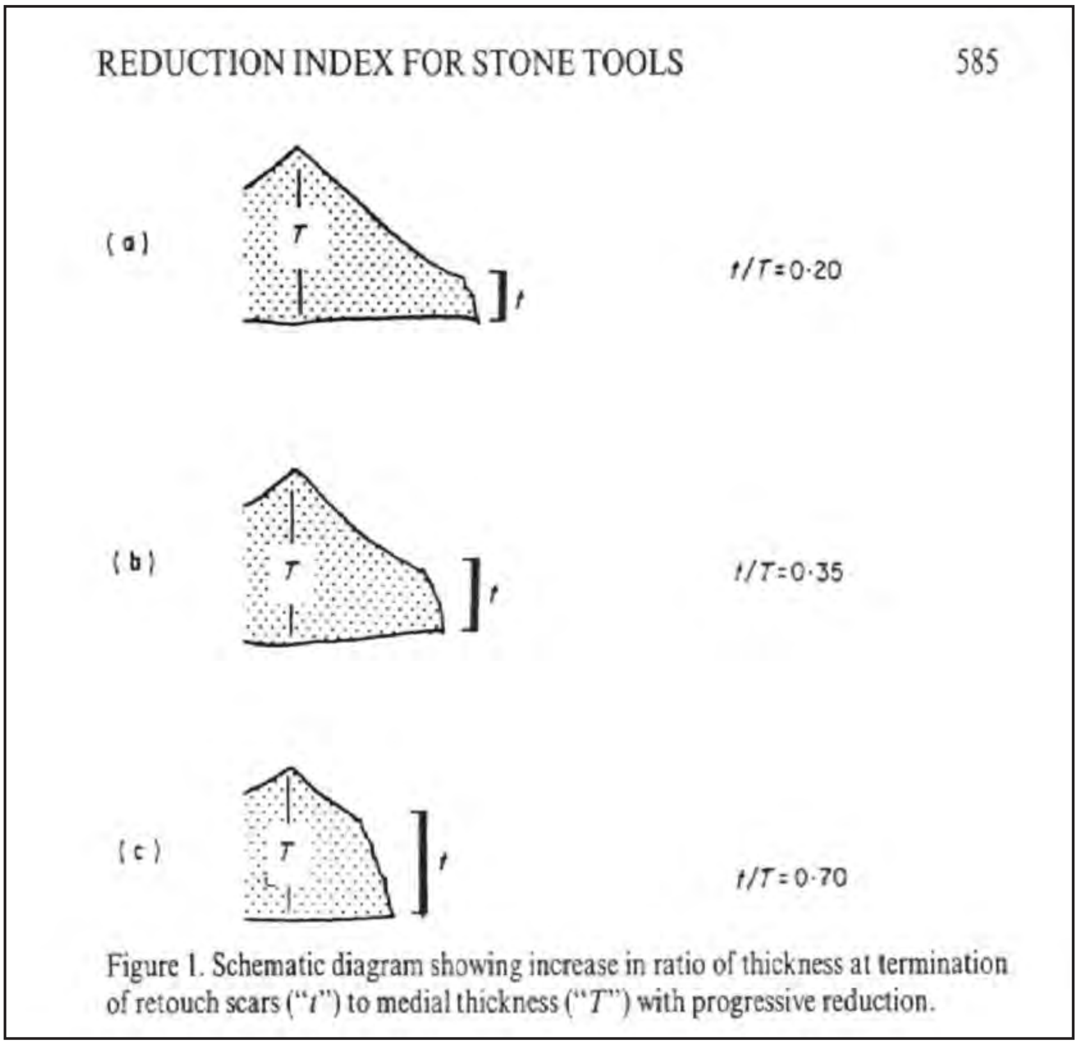


Figure 5.5. Measurments taken in determining Kuhn's Index of Reduction for the Cuatro Vientos Nueces Tools. Figure from Kuhn (1990).

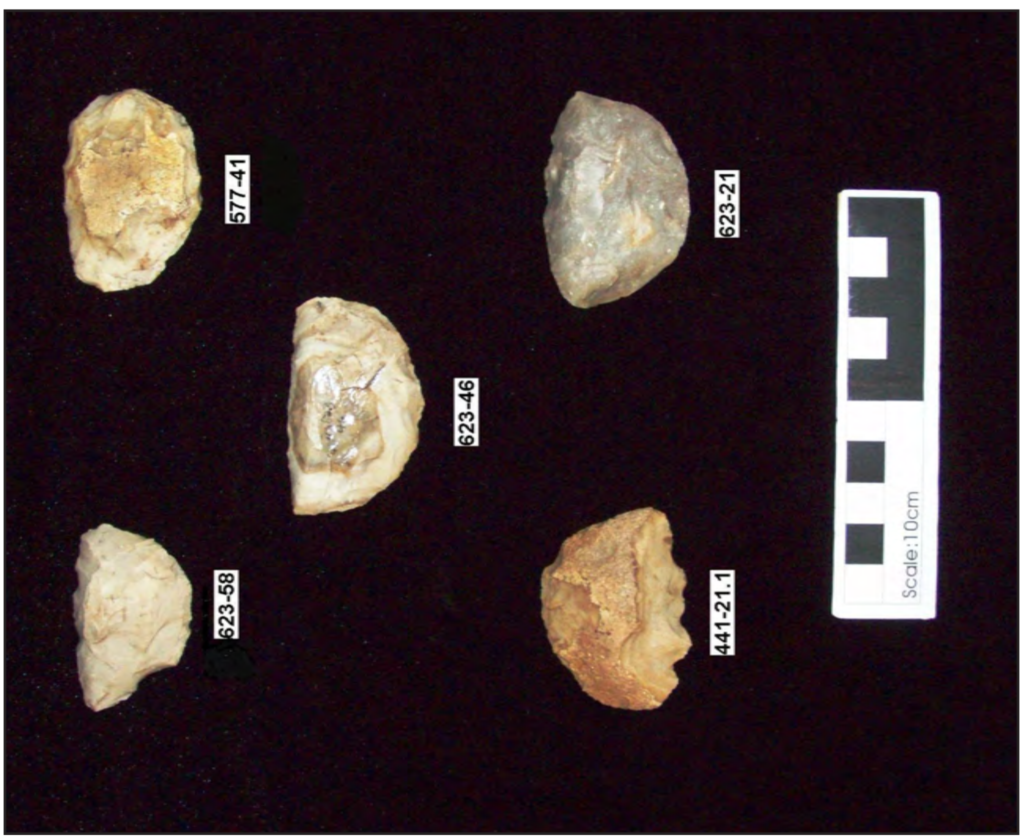


Figure 5.6. Nueces tools with Kuhn's Reduction Index suggesting a transition from mid to late stages.

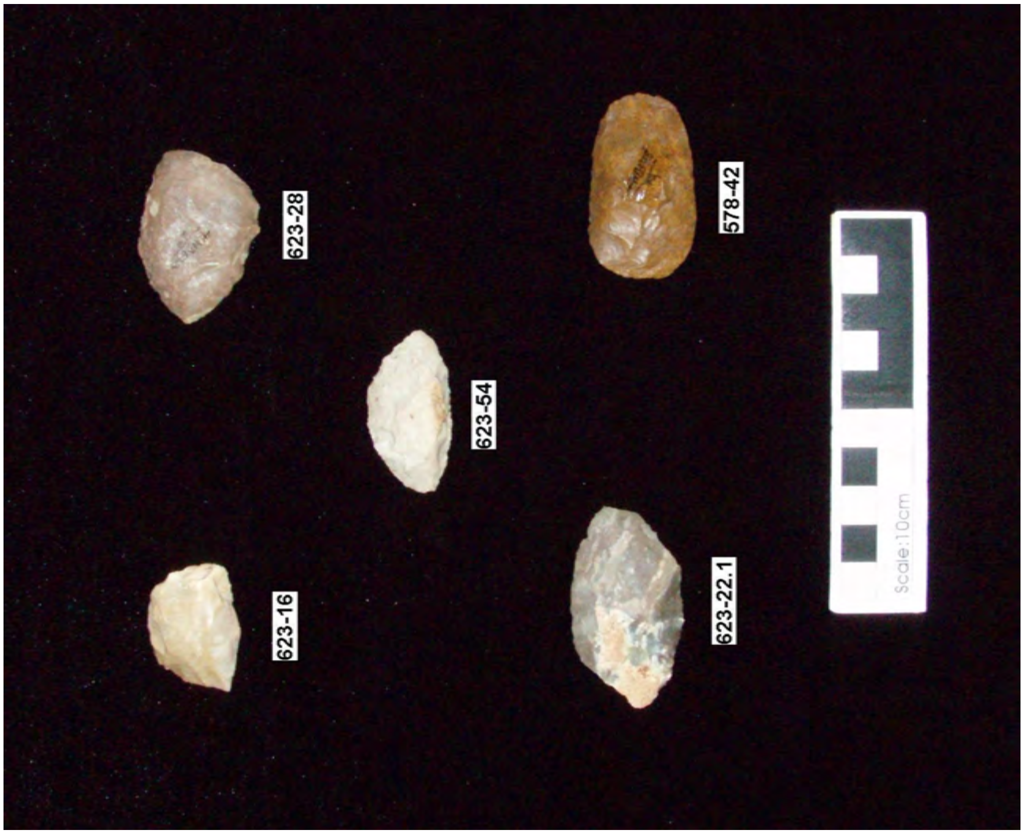


Figure 5.7. Nueces tools showing continued progression of Kuhn's Reduction Index towards later stages.

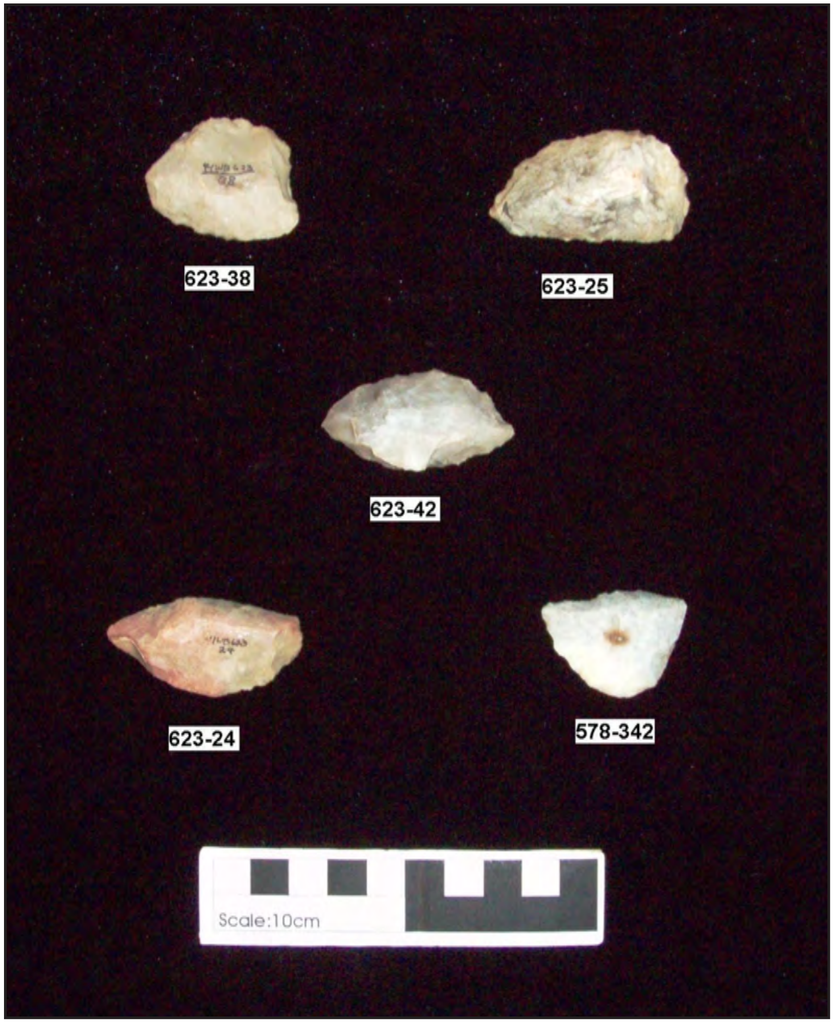


Figure 5.8. Nueces tools with the highest Index readings indicating complete exhaustion.

Figure 5.9. Six Nueces tools with low Kuhn's Reduction Index numbers suggesting early stage.

Table 5.3. Correlations of Quantified Categories

	Weight	Length	Width	Thickness	Ht of Retouch	Average
Weight	1					
Length	0.925	1				
Width	0.407	0.125	1			
Thickness	0.910	0.830	0.359	1		
Ht of Retouch	-0.249	-0.432	0.532	-0.186	1	
Average Distal Edge Angle	-0.574	-0.656	-0.068	-0.629	0.299	1

weight does not correlate strongly (r=.42) with the reduction index, and, expectedly, neither does width.

As Kuhn (1990:592) notes, the geometric index is "a continuous but uncalibrated measure of reduction." By uncalibrated, it would seem he means that interpretations drawn from the findings for each particular dataset should be considered within its unique context. For Nueces tools from Cuatro Vientos, the index appears to be applicable, reflective of actual stages of reduction. Most extraneous variables (raw material availability, flake types, etc.) are considered to have been relatively consistent throughout the project area. An assessment of other correlations contribute to the assessment of patterns.

Edge Angle and Correlations

Generally, edge angle increases over the use-life of scrapers as a result of use-wear and resharpening. In the Cuatro Vientos data there are moderately high inverse correlations between steepness of end angle and length, weight, and thickness, but not significant correlations between angle and width or height of retouch (Table 5.3). The correlations between edge angle and length and weight are rather straightforward: resharpening creates attrition to the distal length and mass of Nueces tools. Regarding the relationship between angle and specimen thickness, studies have noted a general tendency for thicker scraping tools to have steeper angles (Blades 2003:147). The Cuatro Vientos data are consistent with such a trend. Expectedly, the width of a tool is not affected by distal reduction.

Length and Thickness

The ratio of length to thickness is likewise considered directly related to reduction intensity. While maximum thickness remains constant throughout the life of a Nueces tool, the length decreases through its use-life. The Cuatro Vientos data shows a high correlation (r=.83) between the two variables. Among the six Nueces tools with the lowest Kuhn's index (i.e. early stage), the average length to thickness ratio is 3.03, while the remaining later stage tools have an average ratio of 2.77.

Spatial Context

As percentages of formal tool assemblages, Nueces tools constitute 7.9 percent of the Cuatro Vientos formal tool assemblages, with very high percentages in 41WB623 and 41WB441, two sites at completely different ends of the landscape topography (Figure 5.10). Notably, large artifact collections were recovered from sites 41WB577 and 41WB578, but few Nueces tools were identified at these sites. The preliminary suggestion is that the tools from 41WB623 reflect a pattern of discard of exhausted tools. As noted in the cultural implications, both are considered anticipatory personal gear, and their position in the archaeological landscape should likely reflect discard in residential base camps, though these camps could also have been where they were utilized. Accordingly, such tool types should be diagnostic indicators of residential site distribution patterns.

Temporal Context

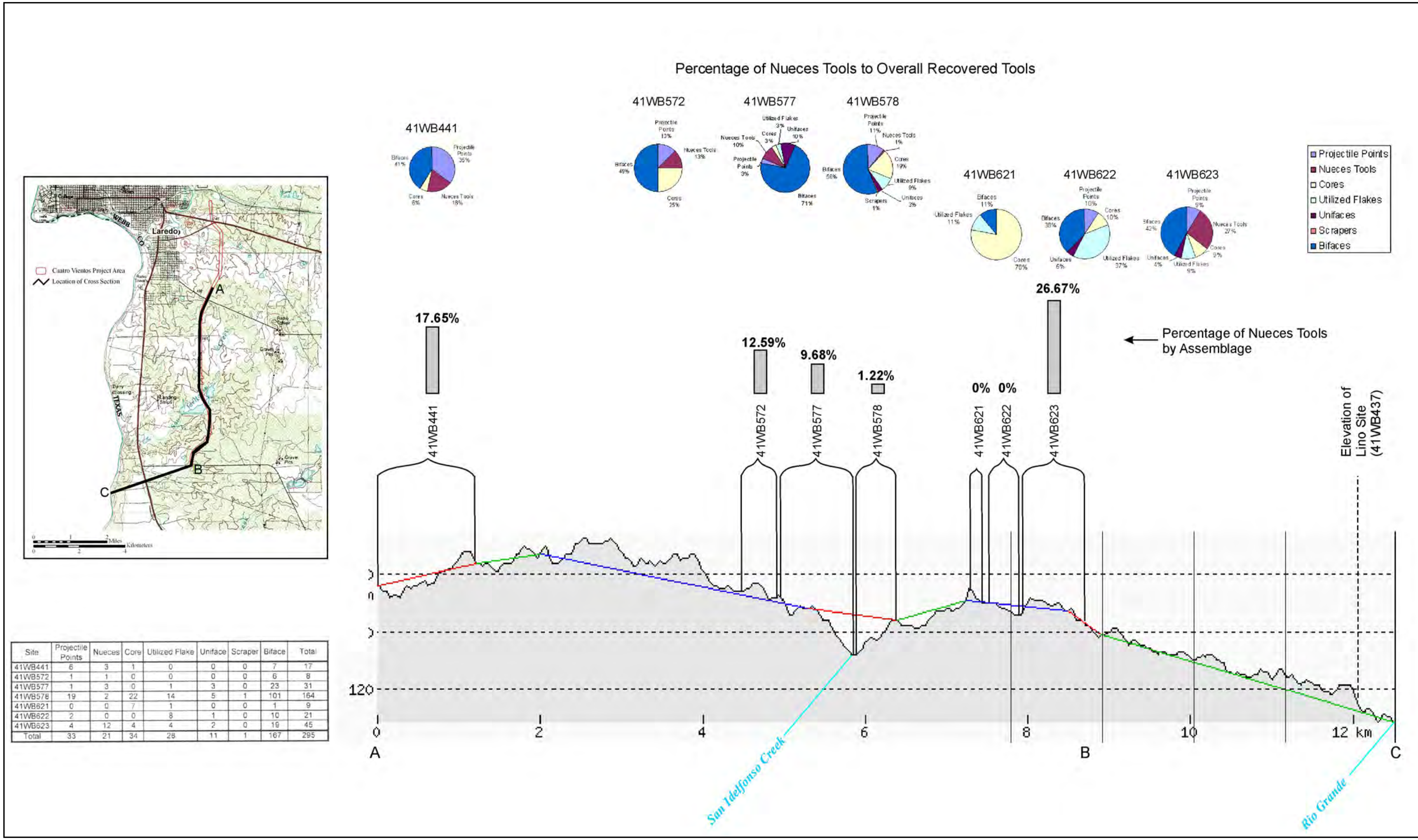
In the previous chapter, the association of Nueces tools with Tortugas points suggested an estimated temporal affiliation with the late Middle Archaic, which dates to approximately 3,100–2,300 B.P. Similarly, the spatial distribution of sites yielding Nueces tools is almost identical to the distribution of late Middle Archaic sites (Figure 5.11). However, Quigg et al (2000) identified both Tortugas points and Nueces tools in Occupational Zone (OZ) 1 at the Lino site, which dates to about 2,000 B.P. In the broader scheme, with most tool and projectile point forms there was apparently a gradual development of form that results in indiscrete temporal boundaries. The Nueces tool grades into Olmos, Dimmit, and Clear Fork tools in formal aspects as well as temporal and spatial distributions.

Discussion: Implications of Nueces Tools in the Cuatro Vientos Right-of-Way

The cumulative data, supported by a series of correlations that serve as crosschecks, provides a view of Nueces tools as curated, personal gear that was repetitively utilized to the point of exhaustion then discarded, likely on residential base camps. Lacking direct dates, a contextual analysis of the co-occurrence of the tools with other temporally diagnostic artifacts suggests dates of roughly 2,300–3,100 B.P., or late Middle Archaic

The intensive use of scrapers, maximizing use-life (exhausting) prior to discard, increased formality of tool form, and a high quality of raw materials could be interpreted as reflecting a “curated” toolkit designed for high reliability and maintainability, a hallmark of mobility patterns distinguished by short duration, low frequency occupations (Bamforth 1986; Binford 1979; Clarkson 2002; Parry and Kelly 1987; Shott 1986). This can be the signature of either forager residential camps or logistical groups. In this case it is likely the latter when considered in light of other lines of evidence discussed in the later chapters.

In considering the spatial aspects of the tools, an important aspect of the archaeological record is the relationship between discarded items and the activities involved in its use. In anticipatory personal gear, items “rarely wear out in the context of their use: personal gear is manufactured and maintained in residential camps” (Ebert 1992:136). For example, though projectile point tips may be common in kill sites, point bases are prevalent in base camps. Accordingly, the Nueces tool is inferred to be part of the archaeological signature of residential camps in the late Middle Archaic periods. The implication is that during the late Middle Archaic 41WB623 and 41WB441, which are at the opposite ends of the landscape were residential base camps. The intriguing pattern is the relative lack of Nueces tools in riparian settings such as 41WB577, 41WB578, the Lino site, Boiler site, and 41WB556. Conceivably, residential base camps were situated on upland projections and riparian zones were exploited primarily by logistical groups.



Site	Projectile Points	Nueces	Core	Utilized Flake	Uniface	Scraper	Biface	Total
41WB441	6	3	1	0	0	0	7	17
41WB572	1	1	0	0	0	0	6	8
41WB577	1	3	0	1	3	0	23	31
41WB578	19	2	22	14	5	1	101	164
41WB621	0	0	7	1	0	0	1	9
41WB622	2	0	0	8	1	0	10	21
41WB623	4	12	4	4	2	0	19	45
Total	33	21	34	28	11	1	167	295

Figure 5.10. Cross section of Cuatro Vientos landscape showing assemblages by topographic setting.

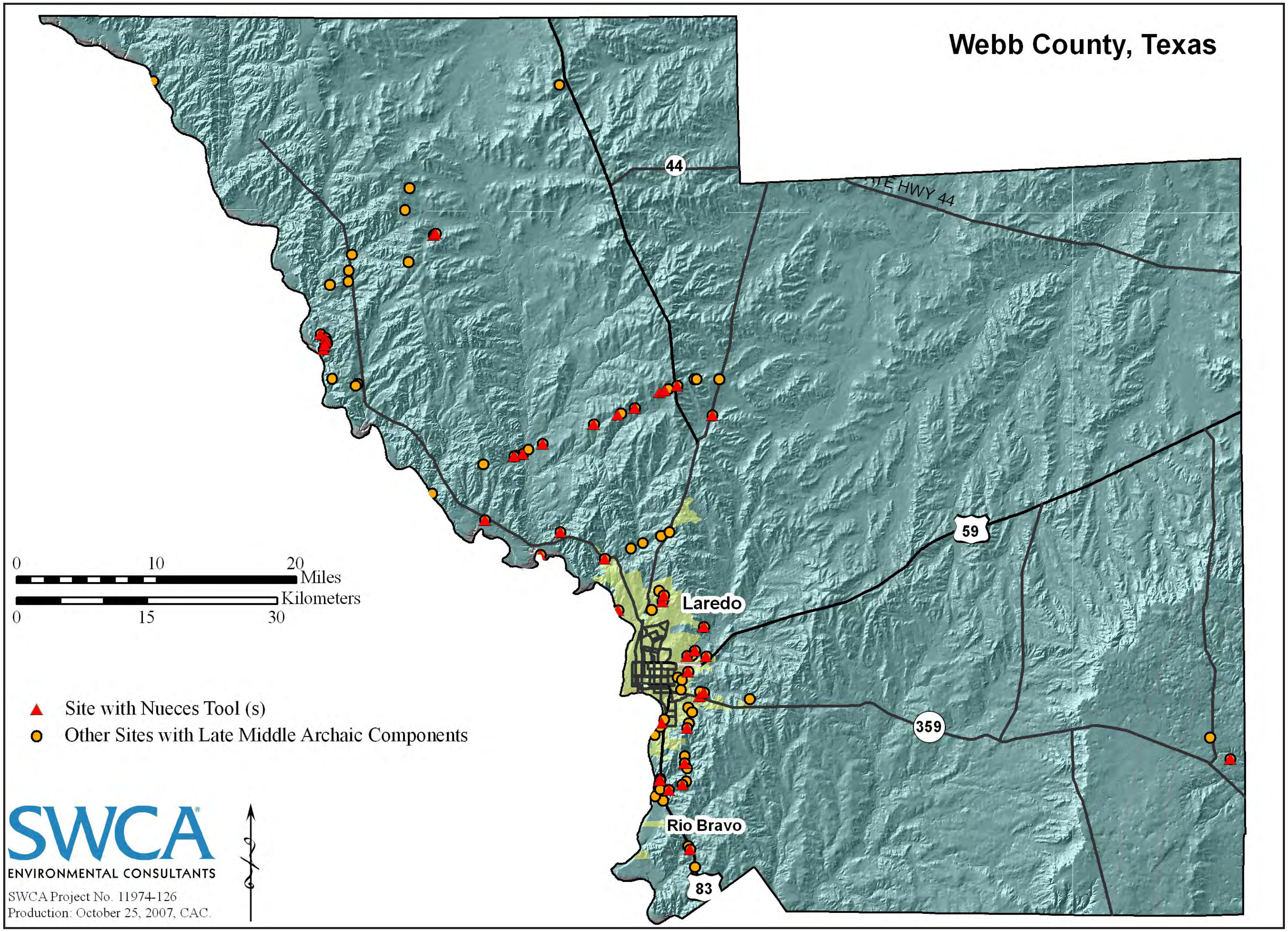


Figure 5.11. Comparison of distribution of Nueces tools and late Middel Archaic site components.

Chapter 6

Form and Function - Burned Rock Features

Despite their numerous contextual problems, burned rock features provide one of the few structural components of the Cuatro Vientos archaeological record, and consequently a potentially significant avenue of research. However, the overall feature assemblage is rather scant, particularly considering only four can be assigned to a chronological period. Nevertheless, consistent with the overall methodology of considering data within its broader context, the Cuatro Vientos features contribute to the development of broader patterns that are inferred to reveal prehistoric behavior. The theoretical implications for the study of features is briefly described here, followed by a discussion of the structure, age, and possible function of the Cuatro Vientos features. This data is then interpreted in light of the broader regional context by utilizing information from sites with burned rock features from Webb County as a whole.

Theoretical Framework of Burned Rock Feature Studies

"Burned rock features...are facilities (or the remains thereof) that represent fire-oriented technologies. Heated rocks provide a simple, yet effective, means of controlling the release of heat and function as heat reservoirs that reduce the level of energy expended to gather fuel and minimize heat dissipation" (Ellis 1997:47). These technologies are most often related to cooking activities where the utilization of "hot rocks" allows the transfer of heat to foodstuffs in a controlled environment. As Ellis (1997) so aptly and thoroughly discusses, a multitude of variables can affect the decision-making process in cooking foods with "hot rocks" including food types, available resources (wood and stone, for example), organizational issues (number of people to be fed, etc.), and desired end-product. The myriad cooking processes involving rocks are represented in the archaeological record by the type, structure, and content of the resultant burned rock features.

Feature technology, specifically the investment of energy into construction and use, is often related to intensification of resource exploitation. Black et al. (1997) see burned rock feature technology as primarily focused on baking of vegetal materials. To wit, "we see 'veggie-baking,' as pithely put by Prewitt (1976), as the main focus of oven cookery and certain plants as prime fodder, namely acorns, sotol, several of the bulbous plants in the lily family, prickly pear, and various geophytes (perennials and underground storage bulbs/roots) including the prairie turnip" (Black et al. 1997:297). These resources are defined as "low-ranked resources", a term commonly used in optimum foraging theory, diet-breadth studies, and general behavioral ecology that refers to caloric return rates relative to the investment of labor in procurement.

Resource ranking has been a useful consideration used in many hunter-gatherer models as an indicator of foraging versus collecting or traveler versus processor (see Bettinger and Baumhoff 1982; Kelly 1995). Regarding its applicability to the Cuatro Vientos research, Dering (1999) has utilized resource ranking, in conjunction with burned rock features, to infer Archaic hunter-gatherer economies and mobility in the Lower Pecos region of Texas. Importantly, Dering's work presents important data on caloric input and yield of plant resources, such as sotol and lechuguilla, which are found in the Cuatro Vientos area.

Cuatro Vientos Burned Rock Feature technology

A total of 13 burned rock features were documented on the seven Cuatro Vientos sites (Table 6.1). As previously described in Chapter 3, these features were in various states of integrity, several being so eroded that the original form could not be discerned. Of note, no extensive midden-like accumulations were identified on any of the sites. Rather all appear to have been single or limited use cooking or heating facilities. Chronological data was obtained from four of the 13 features (Table 6.2) revealing a range of

Table 6.1. Cuatro Vientos Burned Rock Features

Site	Feature No.	Max Diameter	Temporal Affiliation	Basis for Determination	Rock Size <5 cm		Rock size 5 to 10 cm		Rock Size 10 to 15 cm		Rock Size >15 cm		Totals	
					Count	Weight (kg)	Count	Weight (kg	Count	Weight (kg	Count	Weight (kg	Count	Weight (kg)
41WB441	1	ca 100 cm	Late Middle Archaic	2,320 B.P. C-14 date	59	0.41	51	9.9	20	10.8	5	7.7	135	28.81
41WB441	2	50 cm	Late Prehistoric	390 B.P. C-14 date	11	0.15	10	1.5	3	0.57			24	2.22
41WB441	3	35 cm	Indeterminate	No data										
41WB572	1	100 cm	Indeterminate	No data	50+		30+		2				82+	
41WB572	2	100 cm	Indeterminate	No data	100+		60+		5				165+	
41WB572	3	70 cm	Indeterminate	No data	97	1.4	11	1.8					108	3.2
41WB577	1	ca 60 cm	Transitional Archaic	1,670 B.P. C-14 date	9	1.1	11	1.6					20	2.7
41WB578	1	74 cm	Early Middle Archaic	4,150 B.P. C-14 date	16	1.4	66	1.8					82	3.2
41WB578	2	50 cm	Indeterminate	No data	1	0.05	10	2	2	0.6	1	0.9	14	3.55
41WB622	1	150 cm	Indeterminate	No data	73		23		5				101	
41WB622	2	85 cm	Indeterminate	No data	6		12		5				23	
41WB623	1	150 cm	Indeterminate	No data	150+		15+						165+	
41WB623	2	95 cm	Indeterminate	No data	20+		10+						30+	

Table 6.2. Cuatro Vientos Burned Rock Features with Known Chronological Affiliations

Site	Ecological Zone	Feature #	Max Diameter	Temporal Affiliation	Basis for Determination
41WB441	Upland	1	100 cm	Late Middle Archaic	2,320 B.P. C-14 date
41WB441	Upland	2	50 cm	Late Prehistoric	390 B.P. C-14 date
41WB577	Upper tributary riparian	1	60 cm	Transitional Archaic	1,670 B.P. C-14 date
41WB578	Upper tributary riparian	2	80 cm	Early Middle Archaic	4,150 B.P. C-14 date

occupational periods from Early Middle Archaic to Late Prehistoric.

Though the four dated features comprise an insufficient dataset to reveal widely applicable trends, a few salient points are notable for comparison to the broader dataset from Webb County. One of the objectives of the burned rock analysis is the assessment of changes in the investment of labor in burned rock technology through time. According to the four Cuatro Vientos features, the average diameter increases from the early Middle Archaic (80 cm diameter) to late Middle Archaic (100 cm diameter), and then subsequently decreases in size progressively from 60–50 cm in the Transitional Archaic and Late Prehistoric periods (see Table 6.2). In terms of overall weight, the late Middle Archaic feature on 41WB441 is relatively massive (28.81 kg) compared to the early Middle Archaic (3.2 kg). The Transitional Archaic and Late Prehistoric show a decline from 2.70–2.22 kg, respectively. These patterns within this small dataset can be explored and considered in the context of broader trends.

Analysis of Change in Webb County Burned Rock Feature Technology Through Time

While revealing the fact that hundreds of prehistoric burned rock features have been documented, a review of the Webb County data on burned rock features identified a total of 50 features that have been reliably investigated, dated, and reported (Table 6.3). Importantly, all of the features have published data on the total weight of the burned rock that constitute the feature. Originally, the intent was to look at diameter as an index of investment of labor, and doing so would increase the number of features in the database. However, a number of problems were encountered, namely the dispersion of features by erosion or cultural discard patterns that significantly skewed the diameters. Consequently, weight was determined to be the best indicator of energy investment in the construction of burned rock features. The data listed in Table 6.3 is obtained mainly from a few fairly recent investigations, including the Mahoney et al. (2002); Miller et al. (2000); Quigg et al. (2000); Quigg et al. (2002) and the current report.

The 50 features were organized temporally and assigned to the respective chronological periods by date. An establishment of a date for a feature was done through associated radiocarbon samples, diagnostic artifacts, and/or firm stratigraphic position in the site. Accordingly, each chronological period is rather well represented except for the Transitional Archaic with only two dated burned rock features. All other periods have 11–14 features, an ample dataset to define trends. Rather oddly, in terms of archaeological visibility regarding burned rock technology, the Late Archaic is remarkably well represented considering it has the lowest visibility in terms of temporally diagnostic artifacts (Table 6.4). The Late Prehistoric, early Middle Archaic, and late Middle Archaic are well represented, with the Transitional Archaic, as noted, faring poorly in this category.

Table 6.5, Figure 6.1, and Figure 6.2 show the summary statistics of the total weight of burned rock features for each respective time period. The Middle Archaic, collectively, shows the highest investment of labor (as indicated by raw weight) in burned rock feature technology. Initially, the raw data in Table 6.5 and the histogram in Figure 6.1 indicate that the later part of the Middle Archaic shows a slight increase in weight over the earlier part of the era. However, the box-and-whisker plot in Figure 6.2 shows one significant outlying feature that misconstrues the conclusion from the histogram. Figure 6.2 does show a distinctive decline, about a 45 percent, in median weight from the early Middle Archaic to the late Middle Archaic. This trend in median weight continues through the Late Prehistoric. The Cuatro Vientos data is generally consistent with these patterns.

As has been said before, a single line of evidence can be difficult to interpret as far as the overarching cultural implications. In subsequent chapters, burned feature data will be considered in conjunction with other lines of data, but the initial implication is that variable investment of labor into feature technology is correlated with high bulk processing, increase in “site furniture”, and intensity of processing “low ranked resources”, such as “veggies”. In part, these are signatures of collector/processor strategies, and the initial implications are this may be what was occurring during the Middle Archaic.

Table 6.3. Webb County Burned Rock Features with Chronological Data

Early Middle Archaic Features					
Site	Feature	Max Diam. (cm)	Total Grams	Temporal Data	Citation
41WB557	25	45	2104	3840±40, 4150±40, 3730±40 B.P.	Quigg et al. 2002:193-196
41WB557	38	60	5200	3920±40, 4660±50 B.P.	Quigg et al. 2002:226-230
41WB437	24	70	4890.8	Estimated 3260 B.P. based stratigraphic position	Quigg et al. 2000:179-181
41WB557	36	80	8593	Estimated 3500 B.P. based on stratigraphic correlation with Feature 35	Quigg et al. 2002:222-223
41WB437	29	90	1864.7	date of 3460 B.P.	Quigg et al. 2000:181
41WB437	40	90	5430.4	Estimated 3260 BP based stratigraphic position	Quigg et al. 2000:179-181
41WB557	35	90	8167	Circa 3450 BP based on several radiocarbon dates	Quigg et al. 2002:217-222
41WB314	2	135	N/A	4480±50 B.P.	Miller et al. 2000:139
41WB314	M-5	150	34,000	3440±40 B.P.	Miller et al. 2000:136
41WB437	30	160	32704.6	Estimated 3260 BP based stratigraphic position	Quigg et al. 2000:179-181
41WB557	23	25	1517	4200±40, 3950±40, 4090±40 B.P.	Quigg et al. 2002:189-192
41WB578	2	80	3200	4150 B.P	This report

Late Middle Archaic Features					
Site	Feature	Max Diam. (cm)	Total Grams	Temporal Data	Citation
41WB437	39	30	3193.3	Estimated 3000 BP based stratigraphic position	Quigg et al. 2000:149-150
41WB437	42	30	945.7	Estimated 3000 BP based stratigraphic position	Quigg et al. 2000:149-150
41WB437	26	70	827.4	Estimated 3000 BP based stratigraphic position	Quigg et al. 2000:149-150
41WB437	32	40	3013.2	Late Middle Archaic based on Tortugas and stratigraphic position	Quigg et al. 2000:127
41WB437	37	40	1645.2	Estimated 3000 BP based stratigraphic position	Quigg et al. 2000:149-150
41WB557	9	40	1320	Estimated to be 2000-3000 BP based on common Tortugas points.	Quigg et al. 2002:147-150
41WB557	41	25	1814	2680±40. 2600±40, 2280±40, 3510±40, 3410±40	Quigg et al. 2002:231-238
41WB437	22	50	3142.6	Estimated 3000 BP based stratigraphic position	Quigg et al. 2000:153-155
41WB437	28	65	1690.7	Estimated 3000 BP based stratigraphic position	Quigg et al. 2000:149-150
41WB437	20	70	24138.1	Estimated at 2700 BP based on stratigraphic position	Quigg et al. 2000:127
41WB437	27	70	61319.9	Estimated 3000 BP based stratigraphic position	Quigg et al. 2000:149-150
41WB437	18	200	NA	Estimated date of 2700 BP based on stratigraphic position	Quigg et al. 2000:127
41WB441	1	100	28810	2320 B.P.	This Report

Late Archaic Features					
Site	Feature	Max Diam. (cm)	Total Grams	Temporal Data	Citation
41WB437	9	45	4357.6	Stratigraphic affiliation	Quigg et al. 2000:73-91
41WB329	3	50	N/A	Estimated Late Archaic based on association with Desmuke	Miller et al. 2000:91-93
41WB437	8	55	4500	Stratigraphic affiliation	Quigg et al. 2000:73-91
41WB437	10	60	2460.2	2130±40, 2120±40 B.P.	Quigg et al. 2000:73-74
41WB437	13	60	2026.8	Stratigraphic affiliation	Quigg et al. 2000:73-93

Table 6.3. Webb County Burned Rock Features with Chronological Data, continued

Late Archaic Features, continued					
Site	Feature	Max Diam. (cm)	Total Grams	Temporal Data	Citation
41WB437	16	60	2466	Samples taken from occupation levels above and below have age around 2300 B.P.	Quigg et al. 2000:111
41WB437	14	70	29758.8	2470±50, 3190±50, 2290±60, 1950±50 B.P., later values thought to be correct.	Quigg et al. 2000:73-74
41WB437	34	70	3415	Occupation levels above and below have age around 2300 B.P.	Quigg et al. 2000:111
41WB437	35	80	192.1	Stratigraphic affiliation	Quigg et al. 2000:73-91
41WB437	33	80	1611	Occupation levels above and below have age around 2200 B.P.	Quigg et al. 2000:111
41WB437	19	120	2395.9	Stratigraphic affiliation	Quigg et al. 2000:73-91
41WB437	11	125	712.3	Stratigraphic affiliation	Quigg et al. 2000:73-91
41WB437	12	140	23646.6	Stratigraphic affiliation	Quigg et al. 2000:73-92
41WB329	1	200	N/A	2270±60 B.P.	Miller et al. 2000:90
41WB437	3	*	N/A	2060±80 B.P.	Quigg et al. 2000:74
41WB437	15	80	4158.7	Stratigraphic affiliation	Quigg et al. 2000:74
41WB557	17	90	2388	2130±40	Mahoney et al. 2002:47

Transitional Archaic Features					
Site	Feature	Length (cm)	Total Grams	Temporal Data	Citation
41WB557	34	40	1893	1740±40, 1840±40 B.P.	Quigg et al. 2002:212-217
41WB577	1	60	2700	1670 B.P.	This report

Late Prehistoric Features					
Site	Feature	Length (cm)	Total Grams	Temporal Data	Citation
41WB557	22	130	20540	160±60, 180±60, 170±40, 160±40, 410±40 B.P., circa 170 B.P. generally accepted	Quigg et al. 2002:181-189
41WB557	21	40	1508	240±50, 170±60, 270±40, 540±40 B.P.	Quigg et al. 2002:175-181
41WB148		70	N/A	190±60	Warren 1989
41WB557	5	80	N/A	1 Perdiz projectile point	Quigg et al. 2002:141
41WB557	14	80	2472	890±40, 880±40, 860±40 B.P.	Quigg et al. 2002:164-168
41WB363	1	130	N/A	humate sample AD760±60	Warren 1994:24
41WB148		140	N/A	Center of feature - 180±60/ Beneath lower slabs 530±60	Warren 1989
41WB129	5		N/A	Based on recovery of Late Prehistoric arrow point	Warren 1991
41WB129	1		N/A	410±70 B.P.	Warren 1991
41WB556	14	95	3670	220±40 B.P., 100±40 B.P.	Mahoney et al. 2002:47
41WB556	16	70	1170	1040±40 B.P.	Mahoney et al. 2002:47
41WB556	19	85	2310	600±40 B.P., 480±80 B.P.	Mahoney et al. 2002:47
41WB556	20	35	470	300±40 B.P.	Mahoney et al. 2002:47
41WB556	27	185	14370	620±40 B.P.	Mahoney et al. 2002:47
41WB556	23	100	60	610±60 B.P., 500±60 B.P.	Mahoney et al. 2002:47
41WB556	22	70	4480	640±40 B.P.	Mahoney et al. 2002:47
41WB441	2	50	2220	390 B.P.	This Report

Table 6.4. Archaeological Visibility in Terms of Burned Rock Features

Period	Temporal Duration	Millenia	# of Burned Rock Features	Archaeological Visibility Index
Early Middle Archaic	4400 to 3100 B.P.	1.3	11	8.46
Late Middle Archaic	3100 to 2300 B.P.	0.8	12	15
Late Archaic	2300 to 1850 B.P.	0.45	14	31.11
Transitional Archaic	1850 to 1200 B.P.	0.65	2	3.076
Late Prehistoric	1200 to 250 B.P.	0.95	11	11.57

Table 6.5. Descriptive Statistics for Weight of Burned Rock Features by Temporal Period

Descriptive Statistic	Early Middle Archaic	Late Middle Archaic	Late Archaic	Transitional Archaic	Late Prehistoric
Mean	9788.31	10988.34	6006.35	2296.5	4842.72
Standard Error	3584.18	5340.8	2388.96	403.5	1963.75
Median	5200	2413.6	2463.1	2296.5	2310
Standard Deviation	11887.39	18501.1	8938.67	570.63	6513.05
Kurtosis	1.66	4.85	4.17	N/A	2.99
Skewness	1.75	2.21	2.28	N/A	1.94
Range	32483	60492.5	29566.7	807	20480
Minimum	1517	827.4	192.1	1893	60
Maximum	34000	61319.9	29758.8	2700	20540
Sum	107671.5	131860.1	84089	4593	53270
Count	11	12	14	2	11

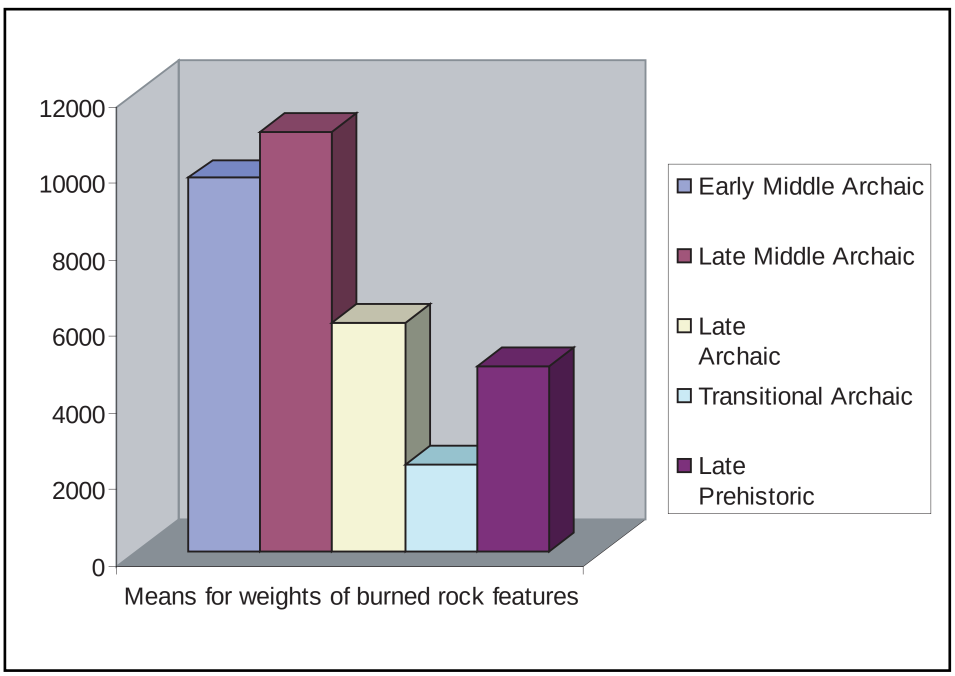


Figure 6.1. Mean weight of burned rock features through chronological periods.

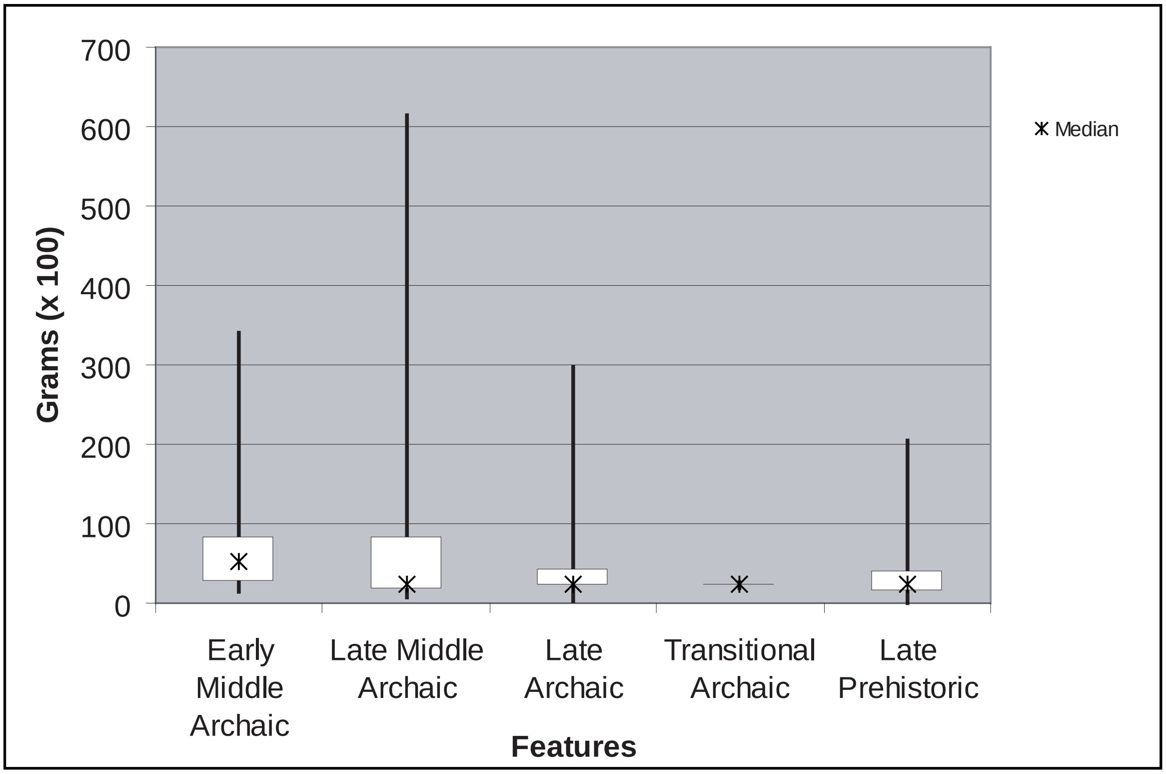


Figure 6.2. Change in burned rock feature weights through chronological periods.

Subsequently, in the later time periods there was a decrease in the intensity of processing of low-ranked resources and a turn towards more of a highly mobile foraging strategy.

Typology of Burned Rock Features

The Cuatro Vientos data is rather poorly suited to functional inferences based on morphology since most were in highly eroded states. However, quite a bit has been done in this area of study in Webb County, and so it will be addressed to the extent possible here. Before drawing functional inferences on the Cuatro Vientos features, basic classifications and definitions are warranted. In Webb County, as well as south and central Texas, as one of the most ubiquitous archaeological elements, burned rock features have been the focus of quite a bit of work on inferring function from the form and construction techniques. Ellis (1997) describes a host of cooking techniques (baking, roasting, grilling, stone boiling, etc.) with probable characteristics of the related burned rock features including structure, shape, rock type, and associated elements such as charcoal, burned earth, macrobotanical remains, etc. Though hindered by the lack of specific lines of evidence such as preserved organics that might indicate the types of foods prepared, examination of the Cuatro Vientos feature characteristics in light of the information from Ellis (1997) allows for the postulation of possible functions.

The burned rock features identified in Webb County can loosely be divided into four functional categories, stone-boiling, fire-places, hearths and ovens. As defined by Johnson (2000:72–73) an oven, distinct from a hearth, is:

> …a facility used for covered roasting or baking. Hot rocks ordinarily placed within a shallow basin or deeper pit and heated there, or nearby, forming a basal heating element. In larger ovens, baking is usually done when food that needs considerable, even lengthy, cooking (e.g. agave and sotol bases, called "hearts") is placed above or among the warmed up rocks of the heating element. Then the whole is covered over with soft plant parts and earth, or even by another layer of heated rocks or cold "lid" rock,

> effectively sealing in the heat for periods of up to several days. Shallow basin-shaped ovens were used for shorter baking episodes, such as overnight.
>
> Hearths, on the other hand, are a pavement of heated rocks, a portion of which is heated by fire, and the remainder utilized as a cooking surface or platform. The archaeological distinction between the two is that ovens comprise a relatively dense concentration of stacked rock, whereas hearths are typically a layer of single rocks.

Hearths and ovens can often be difficult to distinguish, though sometimes ovens are obviously massive features. Fireplaces are typically represented in the archaeological record by a sparse scattering of rock, not a formal layer of rock. Most often fireplaces are most identifiable by the burned soil and ash residue. Ellis (1997:63) notes that "stone-boiling stones would probably appear in small isolated piles or scatters of fire-cracked rocks." In Webb County this has been a common interpretation of many scattered burned rock features, particularly those made of rounded chert or quartzite cobbles (Miller et al. 2000:138–143; Quigg et al. 2000). At the Lino site and 41WB314, the numerous features composed of piles of burned rocks lying on a stable surface with no associated constituents (charcoal, etc.) were interpreted as dumps of discarded boiling stones (see below).

Functional Inferences of Cuatro Vientos Burned Rock Features

Based on these definitions, most features are interpreted as hearths, consisting of a discrete concentration of a single layer of rocks. Feature 1 on 41WB572, however, was more substantial than any other feature and may have represented more intensive processing, but given the degree of erosion such an interpretation is only speculative. Nevertheless, none of the features on the sites are comparable to the large burned rock features found elsewhere in south and central Texas. The features generally consisted of clustered rocks in an approximately 50–70 cm diameter shallow depression.

The most intact of the features, including Feature 1 on 41WB441, Feature 2 on 41WB578, and Feature 1 on 41WB577, are centralized clusters of burned rock inferred to be short-duration cooking features. Some of the features that are scatters of rock strewn across the site surface may be secondary discard piles, but erosion may also be responsible for the configuration of the rocks.

The types of materials used in feature constructions are predominately Laredo formation sandstone with lesser quantities of quartzites and cherts (Table 6.6). The use of quartzites and cherts may suggest some level of stone boiling at the sites though the extent of such activities seems rather limited. Features

Table 6.6. Rock Types of Dated Cuatro Vientos Burned Rock Features

Site	Feature No.	Rock Type	0-5 cm Count	0-5 cm Weight (kg)	5-10 cm Count	5-10 cm Weight (kg)	10-15 cm Count	10-15 cm Weight (kg)	15+ cm Count	15+ cm Weight (kg)	Total Count	Total Weight (kg)
41WB441	1	Chert	2	0.01	2	0.5	0	0	0	0	4	0.51
		Sandstone	57	0.4	49	9.4	20	10.8	5	7.7	131	28.3
		Total	59	0.41	51	9.9	20	10.8	5	7.7	135	28.81
	2/3	Chert	0	0	0	0	0	0	0	0	0	0
		Sandstone	11	0.15	10	1.5	3	0.57	0	0	24	2.22
		Total	11	0.15	10	1.5	3	0.57	0	0	24	2.22
41WB577	1	Chert	3	0.7	2	0.1	0	0	0	0	5	0.8
		Sandstone	6	0.4	9	1.5	0	0	0	0	15	1.9
		Total	9	1.1	11	1.6	0	0	0	0	20	2.7
41WB578	2	Chert	0	0	0	0	0	0	0	0	0	0
		Sandstone	16	1.4	66	1.8	0	0	0	0	82	3.2
		Total	16	1.4	66	1.8	0	0	0	0	82	3.2

that were strictly one sort of rock were primarily sandstone. Though some stone boiling cannot be ruled out, studies of sandstone features of similar structure from sites in the region (see Miller et al. 1999) suggest they functioned as griddles or heating surfaces for roasting, searing, charring, or others food preparation activities.

In regards to one general behavioral interpretation reflected by the burned rock features, all can be inferred to represent single, short-duration use, rather than repetitive, redundant use and long-term occupation as would be indicated by multiple intersecting features. Middens or mounds characteristic of many adjacent regions are typically not found in the Lower Rio Grande Plains.

Comparison to Regional Patterns

All of the features in the Cuatro Vientos assemblage are interpreted as hearths, ovens, or fireplaces, which differ quite a bit from interpretations at other sites in the area that commonly infer stone-boiling. A review of two sites, the Lino site and 41WB314 along the Camino Colombia Roadway explains the intricate reasoning behind the interpretations of stone boiling. Quigg et al.'s (2000) work at the Lino site (41WB437), a stratified Late Archaic campsite located on a terrace of San Idelfonso Creek downstream from the Cuatro Vientos sites, identified 30 burned rock features, including 21 burned rock dumps, four "heating elements" or pits filled with rock, four classified as parts of occupational surfaces, and one undefined (Quigg et al. 2000:246). Almost all feature rock was sandstone with lesser amounts of quartzites. Using excavation results, analysis of burned rock characteristics, and special sampling of organic residues and thermal magnetic properties, Quigg et al. (2000) proposed that stone boiling best explains the burned rock pit, dump, and scatter features at the site.

The hypothesis is based upon several critical considerations (Quigg et al. 2000). First, organized pit features were found with wood charcoal remains (direct rock heating activities) while others appeared to be unorganized dumps with no charcoal. Second, organic residues were found soaked into the rocks. Third, AMS dating of the residues and associated wood charcoal coupled with thermal demagnetization analysis strongly suggested repeated use of the rocks in some type of cooking process. Fourth, an examination of rock sizes and weights amongst the various features indicated significant differences related to rock recycling, stage of rock use, and discard. Using these lines of evidence, Quigg et al. (2000) interprets the Lino site features as the result of the stone boiling process where sandstone rocks are heated in pits, used multiple times in boiling activities, and discarded in dump piles or scatters.

Miller et al. (2000), in a study of numerous surficial and subsurface features on site 41WB314 on Santa Isabel Creek north of Laredo, argued for a similar function for the most prominent feature type, burned rock piles composed mainly of chert. As with the Lino site features, the 41WB314 features appeared to represent differing stages of the stone boiling process, including in situ heating elements and discard piles. The majority of the features were piles of burned rocks lying on a stable surface with no associated constituents (charcoal, etc.). In these features, the stones appeared to have undergone varying degrees of heating as evidenced by the amount of fracturing and discoloration, suggesting possible reuse in multiple cooking episodes. Additionally, the close association of dump piles to heating pits strongly suggested a functional relationship between the feature types. The number of quartzite features with these "stone boiling" characteristics far outweighed the few "sandstone only" features on site 41WB314, which Miller et al. (1999:145) interpreted as functionally different, perhaps utilized as griddles or baking pits.

Raw material, however, were very different between the two sites. At the Lino site, sandstone was almost the exclusive raw materials whereas at 41WB314 and other sites, chert was either common or predominant. In the upland gravel hills of the Rio Grande, chert features have been observed and reported for some time. Warren (1986a, 1986b, 1989a, 1989b, 1992) documented hundreds of burned chert and sandstone hearths in the general Laredo area. At the Los Quemados 200-acre project area just east of Laredo, Warren (1986a, 1986b) recorded over 880 surficial burned chert scatters. Charcoal from the bases of these features dated from 1,570–300 B.P., indicating Transitional Archaic to Late Prehistoric occupations. At the Rachel Mine Permit Area in northern Webb County, Warren (1992) documented hundreds of burned chert and sandstone features from three sites (41WB136, 41WB144, and 41WB148).

The use of cherts at 41WB314 on Camino Colombia suggested purposeful selection of a specific material, probably related to its properties as a heating element. Ellis (1997:54) discusses the ethnographic and experimental analysis of stone material types and heating properties and notes that while limestone breaks down quickly over several episodes of heating/dowsing related to stone boiling, quartzites are more durable:

> By contrast, quartzite appears to be more resilient than other types of lithic raw material when heated and allowed to cool in place. In experiments where quartzite cobbles were exposed to repeated heating/dowsing episodes, the cobbles could be reused for long periods before they exhibited noticeable color changes and jagged breaks (McDowell–Loudan (1983:26). These results are supported by stone boiling experiments conducted by Thoms (1984, cited in Thoms 1986).

With the gravel hilltops in the uplands of Webb County, raw materials would have been readily available. Spherical cobbles provide slightly less surface area per unit of mass than stones with flat or angular faces, but this disadvantage may have been offset by the thermal properties of the stone discussed above. Given a sphere and a cube of the same mass and material, the two objects will be able to store equal amounts of heat. The sphere, however, will cool more slowly because it has less surface area. This may be beneficial in stone boiling because slower transfer of heat to the liquid would result in reduced rates of stone fracturing, thereby conserving materials for future cooking episodes. In this manner, using spherical cobbles may have improved the efficiency of convection, the mechanism for the transmission of heat from the liquid to the food in stone boiling (see Ellis 1997:52).

While stone boiling has been conjectured to be the predominate cooking activity represented by features at many sites in Webb County, other feature types, such as the flat or basin-shaped facilities composed of large flat sandstones, functioned as ovens, hearths, or fireplaces. At Becerra Creek (41WB556), Mahoney et al. (2002) suggest that two-thirds of the burned sandstone features on the site represent hearths or non-stone-boiling functions.

The Cuatro Vientos sites are rather problematical in terms of a stone-boiling interpretation. For the most part, the burned rock was either so dispersed by erosion and other factors, or it comprised small concentrations. While most of the sites in Cuatro Vientos had cherts commonly accessible in the immediate site environs, sandstone was almost exclusively utilized. Functionally, the investigated features, as stated, are considered hearths, ovens, or fireplaces for warming, blanching, roasting, etc.

Perhaps one critical factor is the notion that stone boiling takes moderate to large amounts of water. Though near San Idelfonso Creek, the Cuatro Vientos sites are primarily upland sites, whereas the Lino site is located in a better-watered lower tributary, and site 41WB314 along the Camino Colombia Roadway lies at the confluence of two relatively major tributaries, Santa Isabel and Tejones Creeks. A study on the functional aspects of hearths in time relative to landscape position and possible available resources/processing techniques would be interesting, but beyond the current scope of this study.

Chapter 7

Structure - Organization of Traits and Technology

Introduction

Structure is the relationship among attributes, and, in Deetz's (1967:83) view, how things are organized reveals the rules and laws that govern their arrangement. While classic structuralist analyses are often ideational or symbolic, the notion of structure has been widely applied to hunter-gatherer theory. Binford (1983:144) defined site structure as the spatial distribution of artifacts, features, and faunal remains on an archaeological site. The objective of the study of such structure is the organization of behavior, rather than ideas. Shortly after Binford's work, Leroi-Gourhan (1984) developed a methodology for the study of hunter-gatherer site structure by identifying two organizing principles of archaeological materials, *evidentes* and *latentes* structures. The former are hearths and similar focal points analogous to what Binford called site furniture. Activities are organized around these. Latentes structures are the arrangements of debitage, tools, bone, and other items. These general principles can be applied to the archaeological record on different scales.

In south Texas, site-specific structural analyses are often infeasible because of two problems: palimpsest processes and the issue of contemporaneity. The former is basically the erasing of the organization of structural elements by subsequent occupations. Relatedly, the depositional context of south Texas rarely allows preservation of pristine ethnographically "present" surfaces in which associated, contemporary structural components can be discovered.

To address these problems, two basic analytical tacts are attempted in the analysis of the Cuatro Vientos data, including 1) site distribution patterns and 2) assemblage-based systematics. The first is a macroscale approach that assesses the spatial arrangments of temporal components relative to ecological and economic landscape zones. The intent is to define structural (synchronic) differences in activities across the landscape and then compare components through time to define developmental (diachronic) change. The second step, within the broader context, is an analysis of assemblages of sites in the varying parts of the landscape.

This chapter presents an analysis of the spatial arrangement of artifacts, features, and components across the landscape. Specifically, the data is defined relative to economic/ecological zones to look for differential use of the landscape through time. The information presented here forms the basis for inferring long-term foraging patterns as addressed in the following Chapter 8. Given the body of data that tends to survive in the regional archaeological record, aspects of ecological adaptation are among the most feasible analytical tacts in the south Texas region, and that is certainly true of the Cuatro Vientos area.

Site Distribution Patterns by Economic/Ecological Zones

The economic/ecological zones are defined as follows: riverine riparian sites are located on the Rio Grande alluvial terraces; lower tributary riparian sites are situated along the alluvial terraces of tributaries to the Rio Grande up to several kilometers from the confluence; upper tributary riparian sites are located on the terraces of prominent drainages; and upland sites are situated on the plains and interfluvial projections overlooking drainages in the area.

These divisions, like all ecological divisions, are somewhat arbitrary, but are based on the precedence of using soils as indicators of landscape position (see Stafford 1994). One of the five principle factors affecting soil differentiation is landscape position, which in turn affects all other aspects such as biotic communities. Consequently, the soil landscape position is a good general indicator of ecological zone, which translates into an economic resource zone in terms of hunter-gatherer ecology. The Soil Conservation

Service defines 33 different soil types, which are further classified according to five landscape settings, which are designated “soil landscape positions” (Stafford 1994). Utilizing United States Department of Agriculture (USDA) terminology, these settings include “uplands”, “stream flood plains”, “upland valleys”, “upland valleys and plains”, and “river valleys” (Sanders and Gabriel 1985). River valley soils, covering 0.3 percent of the Webb County landscape, are frequently flooded soils along the Rio Grande. Stream flood plains, covering 1.6 percent of the county, are alluvial settings on terraces above the river valley soils, namely terraces overlooking the Rio Grande. Upland valleys and upland valleys and plains, covering 5.3 and 23.9 percent of the landscape respectively, are higher-elevation settings moving progressively up the tributaries. Finally, uplands, which make up 68.9 percent of the areal coverage, are primarily colluvial settings.

Analysis of the Webb County archaeological sites correlated the site centroids with the soils metadata to define soil types for each site. To a degree using site centroids is a blunt instrument since sites can comprise numerous soil types. It is nevertheless the best available data at this point. Subsequently, each temporal component was relegated to a soil type to determine the distribution of temporal components by landscape position (Table 7.1; Figure 7.1).

Two primary aspects of the data were considered, including the degree of variation in the spatial distribution of archaeological sites and whether there were significant differences in landscape use over time.

Differential Use of the Landscape - Webb County Data

If landscape position played no part in site selection, or if diverse biases effectively served to randomize the data, the expectation would be that sites in Webb County would be found in approximately the same relative density throughout the landscape. For example, 68.9 percent of the landscape is designated upland; so an equivalent proportion of sites would be expected if site distribution patterns were random. Likewise, 23.9 percent of sites would be found in upland valleys and plains, etc.

The analysis of the Webb County data shows some differentiation in site distribution patterns by landscape position and by soil types, but not strong patterns overall. The occurrence of sites is higher than would be expected, assuming an equitable distribution, in upland settings and stream flood plains, but lower than expected in upland valleys and upland valleys and plains (Figure 7.2). River valleys are approximately proportionally represented.

By soil types, which as discussed is used solely as a means of assigning sites to landscape positions as defined by the USDA, the analysis of the Webb County data shows all sites lie within soils that account for 66.4 percent, two-thirds, of the entire Webb Ccounty landscape. The preliminary indication of this statistic is that sites are patterned to some degree, though such an observation warrants much more analysis. In other words, the sites are not equitably or randomly distributed, but rather are restricted to particular portions of the landscape. The distribution becomes more distinctive on a case by case basis. Over a quarter (27.83 percent) of the archaeological components are found in Copita fine sandy loams, which comprise 8.9 percent of the landscape. Though smaller in numbers of components (7.8 percent) and coverage (1.3 percent of the county area), Lagloria silt loams are similarly prolific in site density. Palofox clays, Verick fine sandy loam, and Tela sandy clay loams likewise have disproportionately high numbers of sites.

Soils that are notably lacking sites include Aguilares sandy clay loam, Brundage fine sandy loam, Montell clays, Viboras clays, Cuevitas-Randado complex and Hebronville loamy fine sands. Collectively these soils comprise 31.1 percent of the landscape, but have no recorded sites.

Temporal Variation in Site Distribution Patterns - Webb County Data

With the exception of a few subtle shifts, the data shows no clearly significant variation over time in the site distribution patterns through the successive temporal periods (Table 7.2; Figure 7.3). On a very general level, this suggests substantial structural continuity in landscape use through the latter part of prehistory. However, closer inspection of the divisions within landscape categories may reflect

Table 7.1. Distribution of Webb County Temporal Components by Soil Landscape Position

			Temporal Components											
Soil Name	Landscape Position	% of County Landscape	Early Middle Archaic		Late Middle Archaic		Late Archaic		Transitional Archaic		Late Prehistoric		Total by Soil Type	Total %
			#*	%**	#*	%**	#*	%**	#*	%**	#*	%**		
AgB—Aguilares sandy clay loam, 0 to 3 percent slopes	*Upland*	*5.70*	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	***0***	***0.00***
Ar—Arroyada clay, frequently flooded	*Stream floodplains*	*0.20*	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	***0***	***0.00***
Bd—Brundage fine sandy loam, occasionally flooded	*Upland valleys*	*4.50*	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	***0***	***0.00***
BrB—Brystal fine sandy loam, 0 to 3 percent slopes	*Uplands*	*3.60*	0	0.00	3	3.49	2	8.70	2	3.70	2	4.76	***9***	***4.25***
CaB—Catarina clay, 0 to 2 percent slopes	*Upland valleys and plains*	*8.60*	0	0.00	4	4.65	3	13.04	2	3.70	0	0.00	***9***	***4.25***
CfA—Catarina clay, occasionally flooded	*Upland valleys*	*0.80*	0	0.00	1	1.16	1	4.35	1	1.85	0	0.00	***3***	***1.42***
CoB—Comitas fine sand, 0 to 3 percent slopes	*Uplands*	*0.20*	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	***0***	***0.00***
CpB—Copita fine sandy loam, 0 to 3 percent slopes	*Uplands*	*8.90*	2	28.57	21	24.42	8	34.78	16	29.63	12	28.57	***59***	***27.83***
CRB—Cuevitas-Randado complex, gently undulating	*Uplands*	*2.60*	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	***0***	***0.00***
DeB—Delfina loamy fine sand, 0 to 3 percent slopes	*Uplands*	*0.50*	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	***0***	***0.00***
DmB—Delmita loamy fine sand, 0 to 3 percent slopes	*Uplands*	*0.70*	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	***0***	***0.00***
DRB—Delmita-Randado complex, gently undulating	*Uplands*	*2.70*	0	0.00	2	2.33	2	8.70	2	3.70	1	2.38	***7***	***3.30***
DsB—Dilley fine sandy loam, 0 to 3 percent slopes	*Uplands*	*1.10*	0	0.00	1	1.16	0	0.00	0	0.00	2	4.76	***3***	***1.42***
DvB—Duval fine sandy loam, 0 to 3 percent slopes	*Uplands*	*5.70*	0	0.00	0	0.00	0	0.00	0	0.00	1	2.38	***1***	***0.47***
HeB—Hebbronville loamy fine sand, 0 to 2 percent slopes	*Uplands*	*4.40*	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	***0***	***0.00***
JQD—Jimenez-Quemado complex, undulating	*Uplands*	*4.10*	0	0.00	3	3.49	2	8.70	5	9.26	2	4.76	***12***	***5.66***
LgA—Lagloria silt loam, 0 to 1 percent slopes	*Stream floodplains*	*1.10*	1	14.29	4	4.65	0	0.00	3	5.56	2	4.76	***10***	***4.72***
LgB—Lagloria silt loam, 1 to 3 percent slopes	*Stream floodplains*	*0.20*	0	0.00	2	2.33	0	0.00	1	1.85	2	4.76	***5***	***2.36***
LrA—Laredo silty clay loam, rarely flooded	*Stream floodplains*	*0.10*	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	***0***	***0.00***

Table 7.1. Distribution of Webb County Temporal Components by Soil Landscape Position, continued

Soil Name	Landscape Position	% of County Landscape	Early Middle Archaic #*	Early Middle Archaic %**	Late Middle Archaic #*	Late Middle Archaic %**	Late Archaic #*	Late Archaic %**	Transitional Archaic #*	Transitional Archaic %**	Late Prehistoric #*	Late Prehistoric %**	Total by Soil Type	Total %
MCE—Maverick-Catarina complex, gently rolling	*Uplands*	*13.30*	3	42.86	17	19.77	3	13.04	9	16.67	5	11.90	***37***	***17.45***
MgC—Moglia clay loam, 1 to 5 percent slopes	*Uplands*	*6.40*	0	0.00	1	1.16	1	4.35	0	0.00	0	0.00	***2***	***0.94***
MnB—Montell clay, saline, 0 to 2 percent slopes	*Upland valleys and plains*	*9.90*	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	***0***	***0.00***
Mo—Montell clay, occasionally flooded	*Upland valleys and plains*	*1.60*	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	***0***	***0.00***
NDF—Nido-Rock outcrop complex, hilly	*Uplands*	*0.10*	0	0.00	3	3.49	0	0.00	0	0.00	2	4.76	***5***	***2.36***
NOC—Nido Variant-Rock outcrop complex, gently undulating	*Uplands*	*0.00*	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	***0***	***0.00***
NuB—Nueces fine sand, 0 to 3 percent slopes	*Uplands*	*1.00*	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	***0***	***0.00***
PaB—Palafox clay loam, 0 to 3 percent slopes	*Uplands*	*3.60*	1	14.29	10	11.63	0	0.00	8	14.81	5	11.90	***24***	***11.32***
Rg—Rio Grande very fine sandy loam, occasionally flooded	*River valleys*	*0.30*	0	0.00	1	1.16	0	0.00	0	0.00	0	0.00	***1***	***0.47***
Te—Tela sandy clay loam, frequently flooded	*Upland valleys and plains*	*3.80*	0	0.00	7	8.14	1	4.35	3	5.56	5	11.90	***16***	***7.55***
To—Torriorthents, loamy-skeletal		*0.00*	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	***0***	***0.00***
VkC—Verick fine sandy loam, 1 to 5 percent slopes	*Uplands*	*1.50*	0	0.00	6	6.98	0	0.00	2	3.70	1	2.38	***9***	***4.25***
VrB—Viboras clay, 0 to 3 percent slopes	*Uplands*	*2.40*	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	***0***	***0.00***
ZAC—Zapata-Rock outcrop complex, gently undulating	*Uplands*	*0.30*	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	***0***	***0.00***
Water bodies		*0.10*	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	***0***	***0.00***
	Totals	***100.00***	***7***	***100.00***	***86***	***100.00***	***23***	***100.00***	***54***	***100.00***	***42***	***100.00***	***212***	***100.00***

**-Total number of sites in Webb County by period.*

***-Percentage of sites in Webb County by period .*

Highlighted cells indicate presence of cultural components.

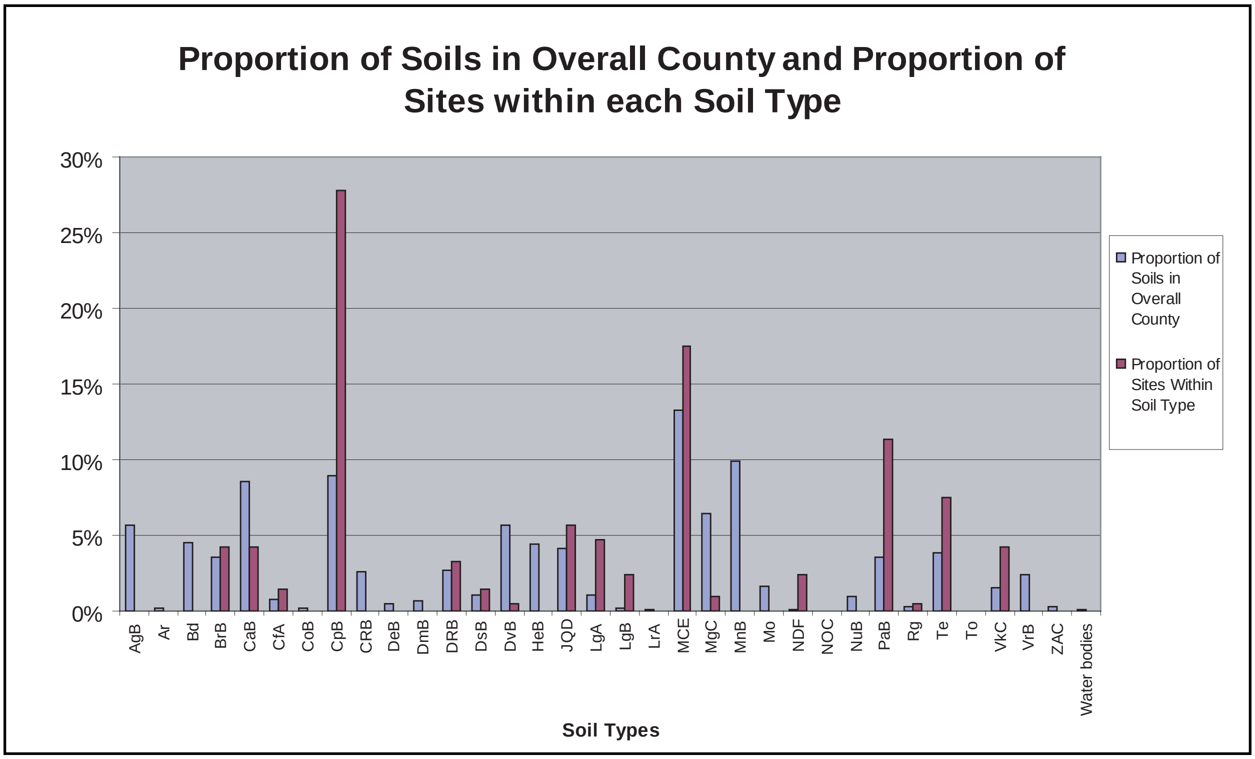


Figure 7.1. Distribution of Webb County temporal components by soil landscape position.

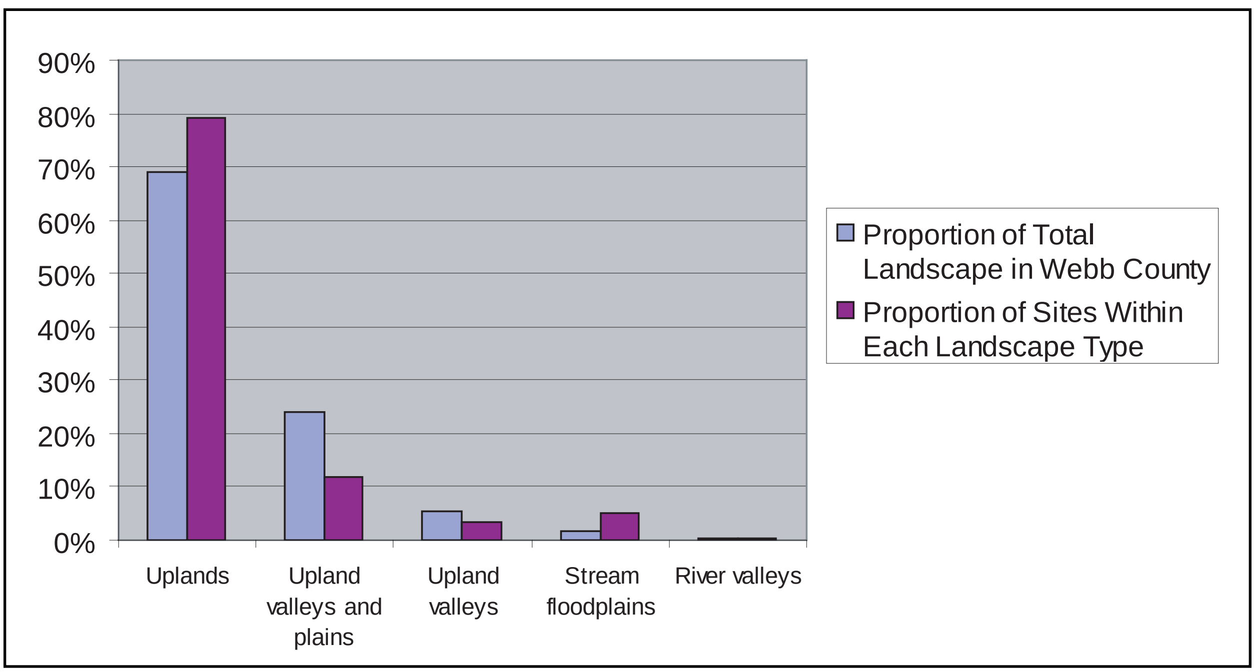


Figure 7.2. Site distribution patterns by landscape position.

Table 7.2. Summary of Webb County Temporal Components by Soil Landscape Position

Soil Landscape Type	% of Total Landscape	Chronological Period											
		Early Middle Archaic		Late Middle Archaic		Late Archaic		Transitional Archaic		Late Prehistoric		Totals	
		#	%	#	%	#	%	#	%	#	%	#	%
Uplands	*68.90*	6	85.72	67	77.90	18	78.26	44	81.48	33	78.57	***168***	***79.25***
Upland valleys and plains	*23.90*	0	0.00	11	12.79	4	17.39	5	9.25	5	11.90	***25***	***11.79***
Upland valleys	*5.30*	0	0.00	1	1.16	1	4.34	1	1.85	4	9.52	***7***	***3.30***
Stream floodplains	*1.60*	1	14.29	6	6.97	0	0.00	4	7.40	0	0.00	***11***	***5.19***
River valleys	*0.30*	0	0.00	1	1.16	0	0.00	0	0.00	0	0.00	***1***	***0.47***
Totals	***100.00***	***7***	***100.00***	***86***	***100.00***	***23***	***100.00***	***54***	***100.00***	***42***	***100.00***	***216***	***100.00***

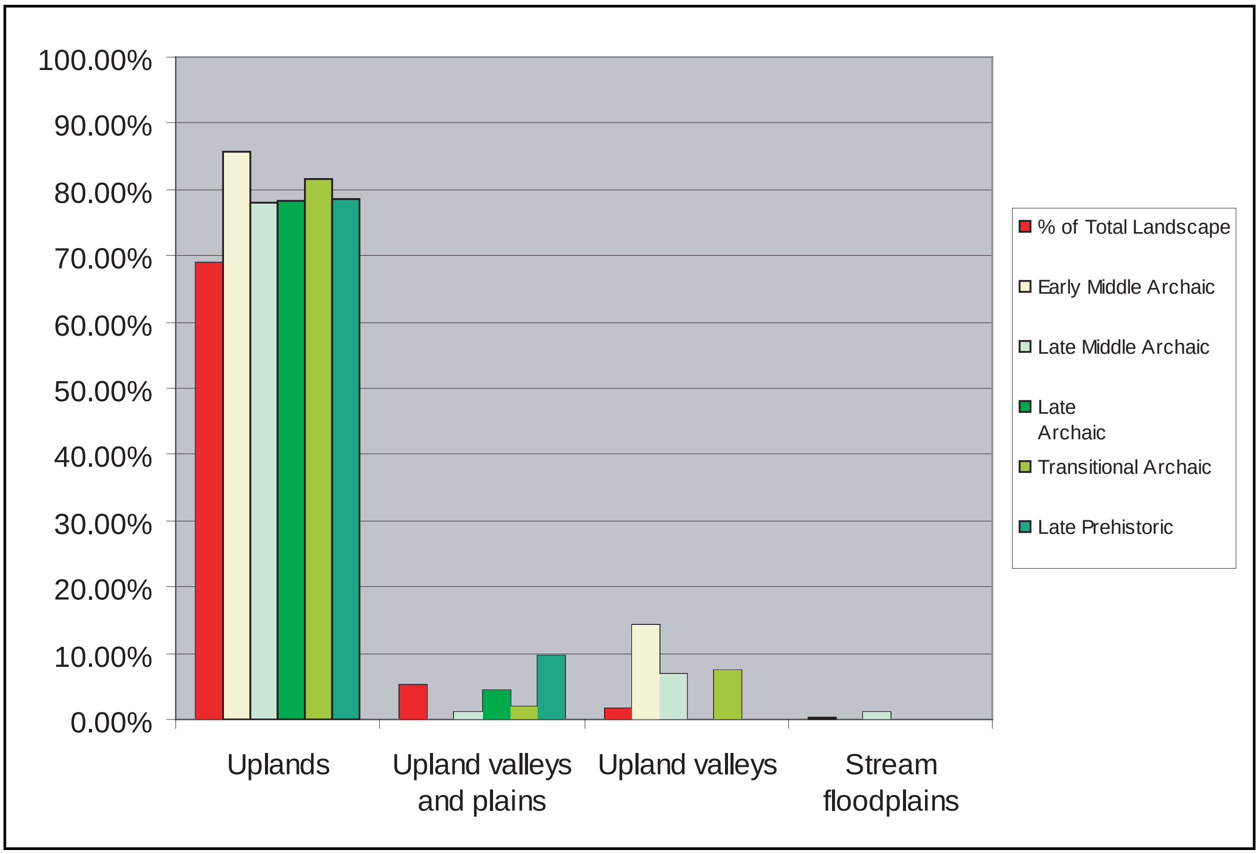


Figure 7.3. Proportion of Webb County temporal components by soil landscape position.

long-term adaptive changes. The broad patterns are discussed here and finer divisions are assessed subsequently in this chapter.

Uplands are the predominant site locales consistently through time with notably little variation in overall percentage. The Early Middle Archaic is slightly more common than the other periods, but the sample size is relatively small, a problem that obscures the trends of this period.

Considered collectively, upland valleys and upland valleys/plains, show a moderate degree of variation. No sites from the Early Middle Archaic are identified in this setting. The Late Middle Archaic and Transitional Archaic percentages are rather consistent and roughly in line, though slightly lower, than the overall percentages of site components in this setting. Late Archaic and Late Prehistoric components in these setting, however, are consistently more prevalent.

The patterns are the opposite for stream flood plains and river valleys, the lower portions of the landscape. Early Middle Archaic patterns are, again, plagued by low numbers, but the Late Middle Archaic and Transitional Archaic, which showed low occurrences in upland valleys and upland valleys/plains, are substantially better represented in the lower elevation settings. Conversely, Late Archaic and Late Prehistoric components, which were common in the upland tributaries, are not recorded in the stream flood plains and river valleys.

Interpretation of Webb County Findings

Based on the Webb County data there appear to be two or three site distribution patterns: an intensive distribution of sites along the lower tributary riparian zones during most of the Archaic, but a move higher up the landscape in the Late Archaic and Late Prehistoric. The Late Prehistoric data seem to indicate more of a bimodal distribution between lower elevations and the upper elevations. While the numbers are not definitive, they present sufficient data to suggest a trend, and a trend suffices to constitute a testable hypothesis. It is important to note that more data is warranted to establish a definitive characterization of the regional prehistoric mobility patterns, and though SWCA has collected the information, it has yet to be systematically assessed.

Nevertheless, if the numbers hold up as data accumulates in time, a plausible general scenario of settlement patterns would be something along the lines of a more intensive occupation and exploitation of concentrated resources during much of the Archaic similar to the patterns defined by Dering (1999) for the Lower Pecos region, with deviation from this pattern during the Late Archaic and Late Prehistoric periods. These latter two periods may represent a more generalized foraging pattern (in relative terms) with the advent of more highly ranked resources, such as bison, during the Late Archaic and Late Prehistoric. The anomaly during the Late Archaic, in which sites are located higher up the drainages is interpreted as a logistical (in terms of straddling the distribution of two critical resources) residential movement towards high return resources – namely bison. Diagnostic artifacts of the Late Archaic, such as Castroville, Montell, and Shumla, are in adjacent regions often associated with the return of bison. These settlement patterns and the archaeological expectations are further addressed in the subsequent sections of this study.

Temporal and Spatial Patterns of Cuatro Vientos Data

Within these broader patterns, the Cuatro Vientos data is utilized to take a finer resolution look at the distribution of components and artifacts. The objectives for the following analysis of data include assessments of 1) how the specific data differs or complies with the general spatial distribution patterns, and 2) how site distribution patterns correlate with intra-asemblage artifact patterns. Regarding the latter, theoretically, differential use of the landscape should coincide with differences in technological organization. In addition to these aims, the analysis of Cuatro Vientos data serves as a critical assessment of the broader trends. For example, in considering the Webb County data, each site was assigned to a particular soil type based on its centroid coordinates. However, as exemplified by the Cuatro Vientos sites, any given site boundary can transcend several soil types.

The Cuatro Vientos sites are situated in two of the five ecological zones (soil landscape positions) defined for the region, so the Cuatro Vientos data represent a segment of the population. However, the two zones include over 90 percent of the total number of archaeological sites in the county, so the patterns should be broadly applicable. Therefore, the analysis of the seven sites is designed to take a finer resolution look at the upper tributary riparian to upland zones, particularly what was occurring on the sites that would explain the larger regional patterns.

The seven sites are mapped within five different soils. Based on the classification of the soils, all seven sites are considered upland sites based on the predominant soil at each, though sites 41WB577 and 41WB578 have parts that contain soils attributable to upland valleys and plains. Sites 41WB441, 41WB621, 41WB622, 41WB572, and 41WB623 are entirely upland settings. However, sites, per se, were not the units of analysis.

As previously discussed, the analysis relied entirely on point plotted data of temporal indicators from the seven sites. These include four radiocarbon-dated features and 47 temporally diagnostic artifacts. Nueces tools are included as temporally diagnostic artifacts based on previous discussions in this report (see Chapter 5). Table 7.3 and Figure 7.4 present the distribution of temporally diagnostic data on the Cuatro Vientos sites by soil type and landscape position.

To generally characterize the data, Late Middle Archaic temporal data is by far the most common, with Late Archaic and Early Middle Archaic eras poorly represented. Transitional Archaic and Late Prehistoric data is marginally sufficient to discern trends. The temporal data is notable in the prevalence of Late Middle Archaic indicators, totaling over 66 percent of the Cuatro Vientos data, which is significantly greater than the overall Webb County percentages (40.57 percent). If considered relative to the timescale of each period in per millennia measurements, the ratio of the Late Middle Archaic is clearly most prominent followed by the Late Prehistoric. Though the data might reveal some patterns such as occupational intensity or maybe population, there are numerous mediating factors that could account for the relative frequency of temporally diagnostic data. There is not a direct correlation between population or occupational intensity and diagnostic artifacts. Nevertheless, it is one aspect, when considered with other lines of evidence that contributes to an interpretation of the prehistoric cultural setting presented in the following Chapter 8. For the purposes at hand, however, at the most basic level the information is simply a measure of archaeological visibility, an assessment of the data population utilized here.

Overall, like the Webb County data, there is a differential use of the landscape in the Cuatro Vientos project area. Relative to the proportion of the soil types covering the sites, Maverick-Catarina soils show a high occurrence of temporal data, whereas Verick fine sandy loams are poorly represented. Maverick-Catarina soils cover 8.33 percent of the site area but includes a third (33.3 percent) of the temporally diagnostic data. Conversely, Verick soils comprise over a third of the area (36.67 percent), but include only 9.8 percent of the diagnostic materials. In the other soils, diagnostic materials are rather equitably represented relative to their proportion of the sites.

The patterns within the uplands, which is what the Cuatro Vientos data are addressing, suggests trends, though the low numbers in some categories warrant caution in placing much confidence in their trends. Within the upland landscape, there is a hierarchy of soils, including upland erosional soils (Maverick-Catarina and Nido-Rock complex), alluvial soils within and immediately along upland drainages (Tela soils), and those that are intermixed alluvial and colluvial formations (Verick and Copita soils) (Figure 7.5). With a single occurrence within the Tela soils, the sample is inadequate. However, if the two higher elevation soils are compared to the Copita and Verick soils, a few tenuous patterns emerge.

Based on this division, the Early Middle, Late Middle Archaic and Transitional Archaic distributions are rather equitable throughout the uplands, but predominant in the higher elevations of the uplands. Conversely, the Late Archaic and Late Prehistoric distributions favor upland drainageways, though the numbers for these periods are comparatively small, particularly the Late Archaic. Nevertheless, if the numbers accurately represent a finer resolution picture of occupation within uplands, it suggests a contradictory or complementary perspective to the overall trends. Whereas in the Webb County data, Early Middle, Late Middle Archaic and Transitional Archaic distributions are weighted towards the lower portions of the landscape, within the upland component of their site distribution patterns, they trend towards the higher ecological zones. Comparatively, the data for the Late Archaic and Late Prehistoric are inconclusive because of low numbers. Taken at face value, however, the simple percentages may indicate the opposite trend - the overall countywide data shows a distribution towards the upper portions of the landscape, but within the uplands, groups are occupying an ecotonal position in the upper headwater tributaries rather than on the upland plains.

Table 7.3. Distribution of Cuatro Vientos Temporal Components by Soil Landscape Position

			Temporal Components											
			Early Middle Archaic		Late Middle Archaic		Late Archaic		Transitional Archaic		Late Prehistoric			
Soil Name	Landscape Position	Proportion of Landscape (%)	% of Component	Cuatro Vientos Data	% of Component	Cuatro Vientos Data	% of Component	Cuatro Vientos Data	% of Component	Cuatro Vientos Data	% of Component	Cuatro Vientos Data	Total by soil type	Total (%)
NDF—Nido-Rock outcrop complex, hilly	*Uplands*	26.67	0.00	0	35.30	12	0.00	0	0.00	0	14.29	1	***13***	***25.49***
MCE—Maverick-Catarina complex, gently rolling	*Uplands*	8.33	66.67	2	29.41	10	0.00	0	60.00	3	28.57	2	***17***	***33.33***
VkC—Verick fine sandy loam, 1 to 5 percent slopes	*Uplands*	36.67	0.00	0	8.82	3	0.00		20.00	1	14.29	1	***5***	***9.80***
CpB—Copita fine sandy loam, 0 to 3 percent slopes	*Uplands*	26.67	0.00	0	26.47	9	100.00	2	20.00	1	42.85	3	***15***	***29.41***
Te—Tela sandy clay loam, frequently flooded	*Upland valleys and plains*	1.67	33.33	1	0.00	0	0.00	0	0.00	0	0.00	0	***1***	***1.97***
	Totals	***100***	***100.00***	***3***	***100.00***	***34***	***100.00***	***2***	***100.00***	***5***	***100.00***	***7***	***51***	***100.00***

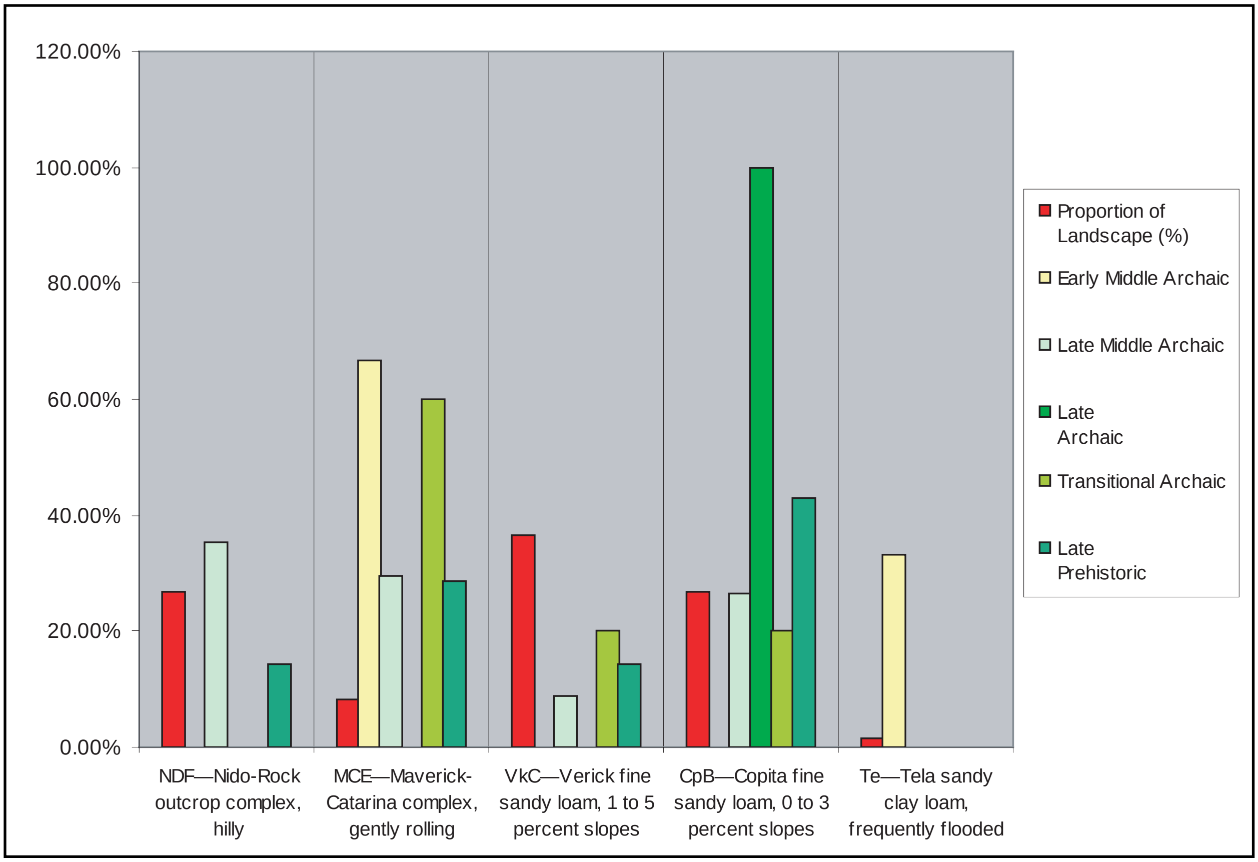


Figure 7.4. Proportion of Cuatro Vientos temporal components by soil landscape position.

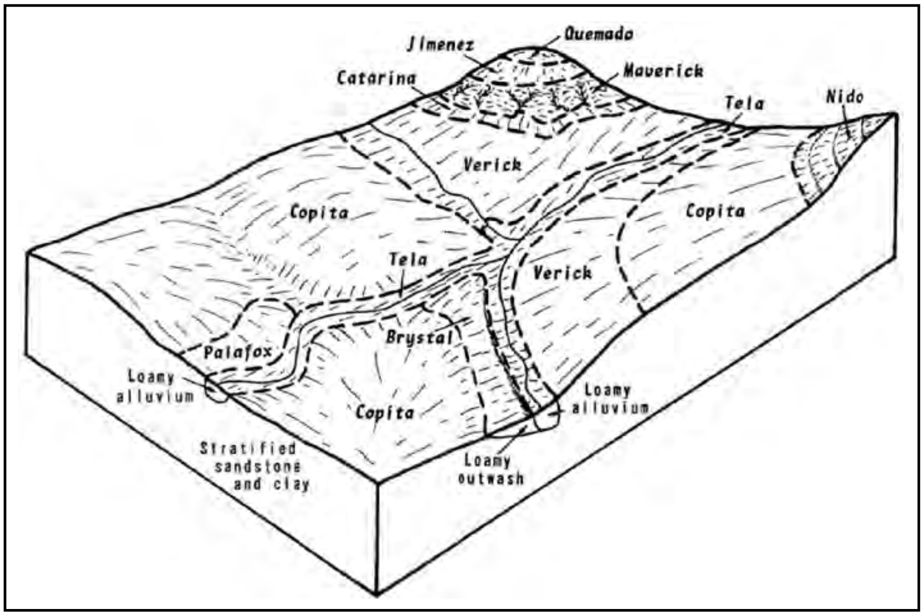


Figure 7.5. Landscape position of upland soils found in Cuatro Vientos showing succession up the landscape from Tela to Copita to Verick to Catarina-Maverick and Nido (adapted from Sanders and Gabriel 1985).

Artifact Assemblages

The spatial distribution of temporal data reveals differential use of the landscape, but does not address the relationships between artifact categories. Of Leroi-Gourhan's (1984) two organizing principles of the archaeological record, *latentes* structures are the most problematic and elusive in the south Texas archaeological record, particularly because of the problem of mixed assemblages on eroded surfaces. Nevertheless, certain aspects are quantifiable. To address the arrangements of debitage, lithic tools, and other items, an assemblage analysis of the Cuatro Vientos data is undertaken here to define what is occurring where, and explore what associations there are among artifact classes.

An assemblage analysis identifies "structural" (what remains the same under a series of permutations) components of a technocomplex. Typically, strictly technological aspects tend to pervade cultural areas, though there should be variation of stylistic attributes within these artifact classes on a more areally-specific basis. For example, in south Texas, various scraper forms such as Nueces, Dimmit, Olmos, and Clear Fork interdigitate temporally, spatially, and technologically. While the functional aspects of these forms may be continuous through the various types, a few non-structural aspects, typically stylistic in nature, provide the basis for distinguishing between assemblages. Some of the artifact forms in south Texas assemblages may have limited utility as culturally diagnostic artifacts. Meltzer (1981), for example, in a study of endscrapers from widely disparate eras and geographic regions, concluded their morphology was almost entirely functional with no discernible stylistic aspect.

Cuatro Vientos Site Data

To assess the assemblage variation of the seven Cuatro Vientos sites, formal and informal tools were plotted as cumulative percentages to show the relative strength of contribution to the overall site collection. Nueces tools are the only formally defined category in the list, which are included to further assess the previous conclusions and implications of the tool category. Table 7.4 shows the raw data of the classes for each site, and Table 7.5 shows the cumulative percentages utilized in Figure 7.6. The data shows some readily apparent trends.

Table 7.4. Lithic Tools Assemblages from the Cuatro Vientos Sites

Site	Projectile Points	Nueces	Scraper	Utilized Flake	Uniface	Core	Total
41WB441	6	3	0	0	0	1	10
41WB572	1	1	0	0	0	2	4
41WB577	1	3	0	1	3	1	9
41WB578	19	2	1	15	5	33	75
41WB621	0	0	0	1	0	7	8
41WB622	2	0	0	8	1	2	13
41WB623	4	12	0	4	2	4	26
Total	**33**	**21**	**1**	**29**	**11**	**50**	**145**

Table 7.5. Cumulative Percentages of Lithic Tools Assemblages from the Cuatro Vientos Sites

Site	Scraper	Uniface	Nueces	Utilized Flake	Projectile Points	Core
41WB577	0.00%	37.50%	75.00%	87.50%	100.00%	100.00%
41WB623	0.00%	8.00%	56.00%	72.00%	88.00%	100.00%
41WB572	0.00%	0.00%	50.00%	50.00%	100.00%	100.00%
41WB622	0.00%	9.09%	9.09%	81.82%	100.00%	100.00%
41WB441	0.00%	0.00%	30.00%	30.00%	90.00%	100.00%
41WB578	1.59%	9.52%	12.70%	34.92%	65.08%	100.00%
41WB621	0.00%	0.00%	0.00%	12.50%	12.50%	100.00%

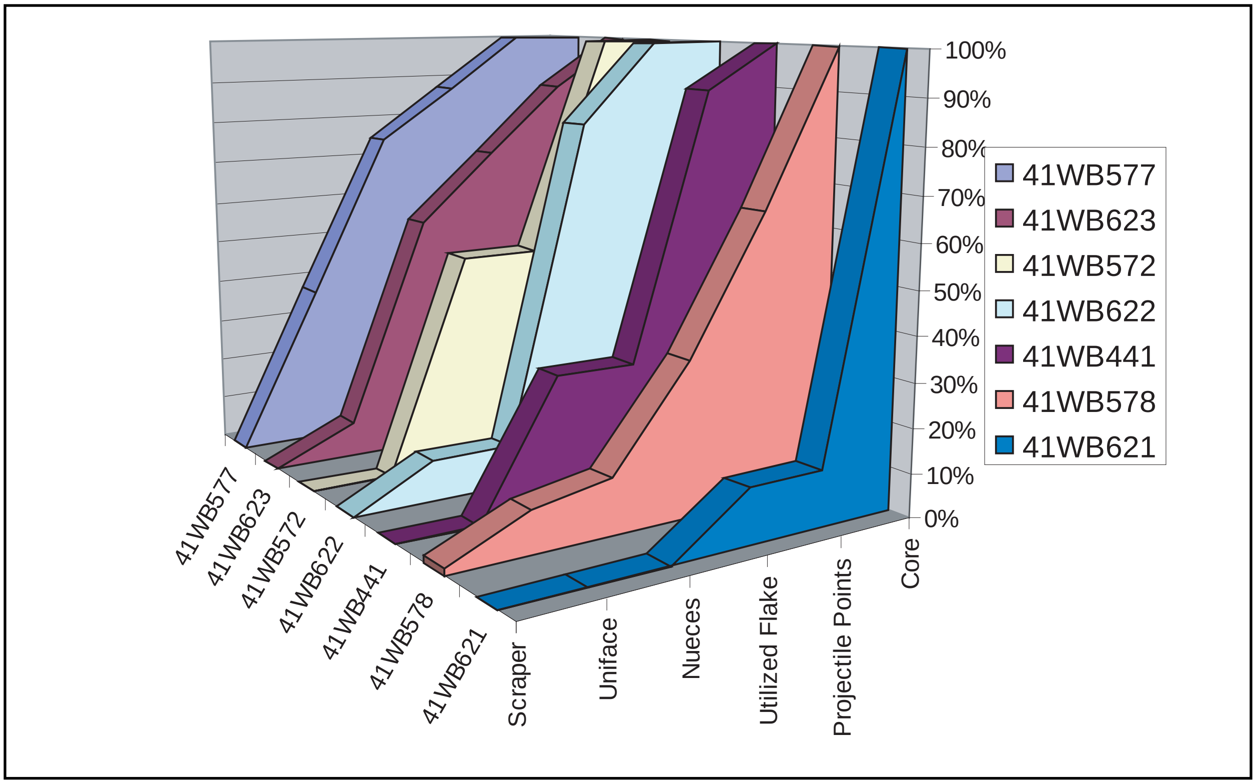


Figure 7.6. Cuatro Vientos assemblages cumulative graph.

Site 41WB621 is interpreted as primarily an upland lithic procurement locale. The archaeological signature of this site type is primarily cores, debitage, tested cobbles, and other early stage reduction debris. Expectedly, there would be low intra-assemblage variation and low percentages of formal and informal tools. Site 41WB621 exhibits such a signature. Within the tools categories, projectile points, utilized flakes, Nueces tools, unifaces, and scrapers constitutes only 12.5 percent of the overall material collection, the lowest of any of the seven sites.

At the other end of the spectrum, sites 41WB577 and 41WB623 show the most internal assemblage diversity. These sites are interpreted as residential base camps, which are broadly characterized in the archaeological record by large assemblage sizes, high internal variability, all stages of manufacturing debris, formal tools of all stages of use and discard, and expedient tools (Ebert 1992:154–156; Kelly 1992:55–56; etc). In 41WB577 and 41WB623, cores decrease in relative contribution, particularly compared to formal tools such as Nueces tools. Some research has suggested high percentages of cores and or bifaces indicate high residential or logistical movement (Boldurian 1991; Kelly 1988; Kelly and Todd 1988), whereas expedient flake tools are a characteristic of more lengthy residential stays (Parry and Kelly 1988). In both cases, interpretation of the collection of materials from these two sites with the highest diversity of materials suggests comparatively longer stays consistent with residential bases.

Between these extremes, sites 41WB441, 41WB572, 41WB578, and 41WB622 show differing degrees of variation. Sites 41WB441 and 41WB572 show distinctive patterns strongly represented by formal tools (Nueces and projectile points), but lacking informal tools (scraper, unifaces, and utilized flakes). Site 41WB572, however, lacks sufficient artifacts to warrant much interpretive value, but 41WB441 yielded a reasonable collection of tools (10 total). Overall, the collections from these two sites have relatively low internal diversity, but they are strongly weighted towards formal personal gear. This pattern can suggest several possibilities, all of which are rather short-duration camps such as logistical locations or traveling camps.

Site 41WB578 and 41WB622 show slightly contrastive patterns with relatively low formal tools and higher quantities of informal tools. Among the formal tools, the lack of Nueces tools is most notable in the configuration of the cumulative curves. Except for the lack of Nueces, however, 41WB578 has a fairly high intra-assemblage diversity more reminiscent of the residential camps 41WB577 and 41WB623. Site 41WB622 is interpreted as a short-term, small-group camp such as a foraging location for resource extraction of some sort.

Comparison of Cuatro Vientos Data to Lino Site

For comparative purposes, the Cuatro Vientos site assemblages are considered relative to the Lino site, which is located near the confluence of San Idelfonso Creek and the Rio Grande. Though it is closer to the riverine riparian zone at the confluence of the Rio Grande and San Idelfonso Creeks, its landscape position according to the soil nomenclature is still upland valley similar to some of the Cuatro Vientos sites. Regarding another aspect, whereas the Cuatro Vientos sites are almost entirely mixed assemblages, the Lino site has stratified late Middle Archaic to Late Archaic components, allowing an evaluation of diachronic patterns. The purpose of drawing comparisons is to bring finer resolution to the patterns in the Cuatro Vientos data, but also critically assess some of the possible flaws.

Quigg et al. (2000) defined six occupational zones, each with a suite of radiocarbon dates that yielded median dates for each zone (Table 7.6). The zones represent successive 150–400 year increments spanning a 1,400 year period from approximately 3,400–2,000 B.P. Using the Cuatro Vientos chronological divisions (the Lino site authors used slightly different divisions), OZ 1 falls within the Late Archaic period, and the remainder of the zones fall within the late Middle Archaic. For the most part, the assemblages of each occupational zone are fairly consistent, dominated by informal tools, a consistent but proportionally low contribution of projectile points, and notably low numbers of Nueces tools (Table 7.7; Figure 7.7). OZ 1 is slightly different as a result of a high number of scrapers and presence of Nueces tools. However, for the most part, the numbers for each zone are rather remarkably uniform, which was interpreted as a rather stable adaptive strategy through time. These components were interpreted as deriving from generalized hunter-gatherer groups staying on the site for one or two nights while carrying out a variety of residential activities (Quigg et al. 2000:264).

Table 7.6. Cumulative Percentages of the Tool Categories at the Lino Site

Site	Scraper	Nueces	Utilized Flake	Projectile Points	Core
41WB437 OZ1	24.24%	30.30%	90.90%	100.00%	100.00%
41WB437 OZ2	0.00%	0.00%	83.33%	83.33%	100.00%
41WB437 OZ3	4.44%	4.44%	79.99%	97.76%	100.00%
41WB437 OZ4	1.20%	1.20%	83.12%	91.55%	100.00%
41WB437 OZ5	0.00%	2.56%	89.73%	94.85%	100.00%
41WB437 OZ6	0.00%	0.00%	85.71%	100.00%	100.00%

Table 7.7. Cumulative Percentages of the Tool Categories at the Lino Site

Site	Projectile Points	Nueces	Scraper	Utilized Flake	Core
41WB437 OZ1	100.00%	30.30%	24.24%	90.90%	100.00%
41WB437 OZ2	83.33%	0.00%	0.00%	83.33%	100.00%
41WB437 OZ3	97.76%	4.44%	4.44%	79.99%	100.00%
41WB437 OZ4	91.55%	1.20%	1.20%	83.12%	100.00%
41WB437 OZ5	94.85%	2.56%	0.00%	89.73%	100.00%
41WB437 OZ6	100.00%	0.00%	0.00%	85.71%	100.00%

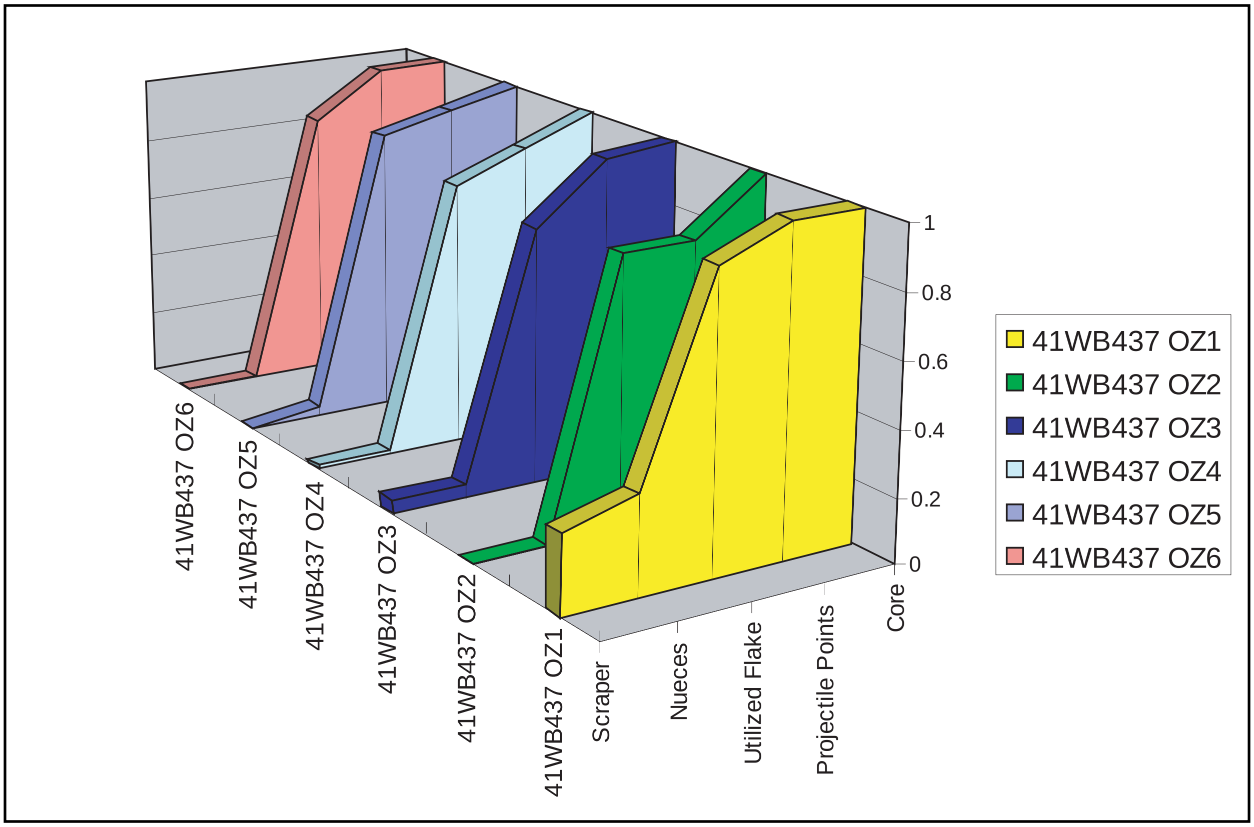


Figure 7.7. Lino Site asemblages cumulative graph.

Before drawing comparisons, it is worth noting the omission of "unifaces" from the Lino site data. This is the result of differing analytical categories that are not directly translate-able. The Cuatro Vientos analyses defined this tool category as unifacially retouched flakes that were not included within another formal category (e.g. Nueces tools). The Lino site analyses included this tool category within other formal and informal classes. It is simply a discrepancy in the definition of tool categories (lumpers versus splitters). Though it imposes a degree of incomparability, certain trends are still evident nevertheless.

Assemblage studies have long sought to address the cumulative effects of multiple occupations upon assemblage diversity. In settings such as in the Cuatro Vientos sites, diachronic resolution is lacking. However, the the Lino site data offers one of the few records that provide insight into such effects. If the five Middle Archaic occupational zones at the Lino site are collapsed into a single collection, the overall assemblage percentages remain almost indistinct from any of the five constituent zones. If this pattern holds true, then in the Cuatro Vientos sites where the temporal data predominantly suggests repetitive occupations *within* a chronological era, the internal composition percentages should remain consistent through continual inputs.

To compare the Lino site data to Cuatro Vientos sites, the Lino assemblage has the least in common with 41WB621, a lithic procurement site, and most resembles 41WB622, a short-term camp. The five late Middle Archaic components of the Lino site have notably low numbers of scrapers, both informal and formal, compared to sites such as 41WB623 or the Boiler site (41WB557) on Becerra Creek several kilometers south of Cuatro Vientos. The one exception to this trend on the Lino site is OZ 1, which is part of the Late Archaic. A third of its tool assemblage is scrapers, including two Nueces tools and eight informal scrapers.

If the site assemblage is reflective of the occupants "tool kit", it appears rather stable throughout the first five occupational zones then shifts in the final occupational zone. Considering the total data from the Late Archaic component, it has distinctively the most diverse assemblage of any of the zones (Table 7.8) (Quigg et al. 2000:253). OZ 1 has nearly every artifact class and feature type. The implications of diversity suggested a range of activities generally associated with people of both genders, maybe family units over the course of more than a couple of days (Quigg et al. 2000:110).

Discussion of Assemblage Diversity - Implications

> "Variation in the structure and content of an archaeological assemblage is directly related to the form, nature, and spatial arrangement of human activities…we are forced to seek explanations for the composition of assemblages in terms of variations in human activities" (Binford and Binford 1966:241).

One component from the Lino site does not comprise a trend, but it is one of the only isolable diachronic records of the period identified in the area. Considered in conjunction with the broader trends, based on the previously discussed temporal variation in the landscape use, the change from the Middle Archaic cccupation zones to the Late Archaic aged component coincides with a shift from more intensive occupation of the lower portion of the landscape in the Middle Archaic to a move towards a more ecotonal position in upper tributary riparian zones in the Late Archaic. One plausible model for what is occurring at the time is a transition from a more logistical occupation to more mobile residential pattern along the lines Shott (1989:296) generally describes as follows:

> "Foragers" (sensu Binford) occupy relatively fine-grained habitats that require or reward high mobility frequency (Kelly 1983, Shott 1986), and essentially the same set of activities is carried out in successive camps. Binford

Table 7.8. Summary of Material Classes Per Lino Site Occupation Zone Showing Assemblage Diversity in Zone 1

	Occupation Zone						
Class	**1**	**2**	**3**	**4**	**5**	**6**	**Misc**
Projectile Points	3		8	7	2	1	3
Abrader	5			2	1		
Mano	1		1	1	2		
Hammerstone		1			1		
Biface	4	3	8	8	11	1	11
Drill	1						
Graver	1						
Unclassified Scraper	2						
Clear Fork Gouge/Scraper	1		1				1
Side Scraper	2						
End Scraper	2		1				
End & Side Scraper	1						
Nueces Scraper	2				1		
Mussel Shell Pendent	1						
Edge-Modified Tool	20	15	34	68	34	6	26
Lithic Core		3	1	7	2		3
	Features						
Burned Rock Discards	9	3	1	5	3		
Burned Rock Pits	1		1	1			
Mussel Shell Clusters	2						
Mano Clusters					1		

> (1980:9) describes their predominant land-use practices as "residential"; virtually the same subsistence activities are conducted regularly if not daily from a single camp shared by all group members. Storage is uncommon, and relatively small, predictable daily inputs characterize subsistence. The !Kung studied by Yellen (1977) approximate the forager ideal, as do a number of other ethnographically documented groups …It bears emphasizing that forager groups in Binford's terms are not confined to low latitudes. His model describes the structure – spatially dispersed or homogenous resource distributions – not the content of forager habitats."

The archaeological assemblage of a forager residential camp should reflect a broader range of activities than a more limited, functionally distinctive logistical camp.

This chapter looked at two differing aspects of the archaeological record, namely spatial distributions and assemblages, in an effort to begin to characterize the data and draw certain conclusions about the area's prehistory. The following chapter will synthesize this assemblage and spatial distribution data in an effort to develop a model of long-term foraging strategies for the area. Prior to that, a brief discussion of the implications of assemblage diversity is warranted to define some of the theoretical problems that affect interpretation.

As a final consideration, the implications of variability have a bit of a long and contentious history. Variability has been inferred to indicate whether the differences indicate different social groupings (e.g. Bordes 1953, 1978, 1984) or simply differing toolkits adapted to differing situations unreflective of social identities (e.g. Binford and Binford 1966). Rolland and Dibble (1990), in a synthesis of Paleolithic variability, rather strongly come down on the latter side, showing that much of Bordes's typological distinctions are the effects of factors such as raw material availability, different reduction intensity, seasonal differences, and variable availability of game, rather than "ethnic traditions." Most American archaeologists tend to adopt this perspective in line with Binford's original argument. However, Bordes's contribution was perhaps the thorough development of assemblage-based systematics (Bordes 1961, 1968) in his work on Mousterian assemblage types. Currently, assemblage comparisons are the foundations of all currently configured archaeological cultures in Texas, but defining subdivisions within a culture has been problematic.

Conclusions

The data presented in this chapter shows changes in site and artifact distribution patterns in the Cuatro Vientos project area and within the broader area. Some patterns are more prominent than others, and some are rather subtle. All clearly need rigorous assessment in the light of additional data. In part the nature of the data is marked by vagueness derived from overlapping sets of information that grade incrementally from one to the next. One possible, and common, conclusion is that no distinctions can be drawn. For example, Matamoros and Tortugas intergrade to such a degree that no viable separation can be discerned. This problem is a central theoretical issue in south Texas archaeology. The objective here is to keep hammering at the problem with multiple approaches to develop a cumulative body of information from which patterns emerge. Ultimately, however, cultural processes over time and across space may have been marked by structural continuity, and deviation from the main adaptive patterns was and is largely obscured.

Nevertheless, using components and temporally diagnostic information, the data shows differential use of the landscape. Additionally, the data suggests variation in these patterns through the successive cultural periods. Though according to statistical tests the significance level is, by the most stringent standards, low on the correlations, acceptance of the null hypothesis (that there is no relationship among the variables) is a "sin of commission" (Shennan 1988:52). Lack of strong evidence for the hypothesis is not evidence for the acceptance of the null hypothesis. In part the lack of certainty may well derive from an insufficient body of data, but that is the limitations of the data at this point. As Cowgill (1977:359) notes, "the significance level considered somehow 'suggestive' or 'interesting' can be related to sample size", by which he means a small sample size may have very low significance levels while large sample sizes warrant much higher significance levels. For the purposes of the current study, the data provides the basis for a theory-driven hypothesis – the main point is to provide a general characterization of the larger population. At this point we are simply identifying suggestive trends.

Accordingly, between the two possibilities, one of cultural stability and the other of significant changes through time, the data seems to support some change in land-use patterns over time. Specifically, the Late Archaic and Late Prehistoric periods exhibit different patterns than the other Archaic eras, and more notably from the population as a whole. The cultural implications are that site distribution reflects mobility and adaptive strategies, and change through time denotes cultural change. Within the terms of the traveler/processor (Bettinger and Baumhoff 1982) and forager/collector spectra (Binford 1980), the data addresses a prevailing general notion that the Late Archaic, Late Prehistoric and ethnohistorical groups of the Lower Rio Grande Plains tended towards the traveler/forager side of the spectrum, and the Middle and Transitional Archaic were generally on the collector and processing side of the spectrum.

If these archaeological signatures have merit, differentiation of prehistoric occupational behaviors ought to be distinguishable in the archaeological record. The analysis of assemblages indicates there is variation in the organization of technology and spatial distribution. Though there are few datasets to address the issue, the available evidence can be explained in the context of the site distribution patterns and models of long-term foraging strategies.

Chapter 8

Behavior - Long-Term Foraging Strategies

Archaeology tries to "reconstruct extinct cultural systems" by discerning "past behavioral patterns" (Deetz 1967:105). Towards this end, much of this report has attempted to look at artifacts and features in their spatial and temporal contexts to identify site distribution patterns, which are then used to determine adaptive strategies.

Foraging strategies pertain to the ways in which the site occupants organized themselves and their technology to interact with their physical setting. The general approach to the analysis of these strategies at the Cuatro Vientos sites will be to look at the relationships among three data sets: 1) assemblage data, 2) environmental data, and 3) the technological body of information. Each of these sets of data has previously been explored in this report. The objective in this chapter is to synthesize the information and propose a model of long-foraging strategies that explain the data, can be tested by future work, and is predictive.

In very general terms, the relationship among the three sets of data is one of covariant change, in which a change in one instigates a change in the others, but not in a deterministic way. The spatiotemporal structure of the landscapes resources allow certain possibilities that prehistoric groups exploited by arranging themselves in certain advantageous ways, developing a technology to exploit the resources. As the resource structure changed either cultural developments or environmental fluctuations, cultures reconfigured themselves and their technology to adapt to new circumstances. A large body of middle range theory, much of it deriving from ethnographic studies, contributes to an understanding of the dynamics among the datasets. To establish a basis for this, a review of the theoretical bases is warranted.

Basic Overview of Foraging Models

In ecologically-driven models, hunter-gatherer settlement patterns are related in part to the spatiotemporal structure of the landscape, notably vital resources. In simplistic terms, foragers maintain small dispersed groups that are residentially highly mobile, "mapping on" (Binford 1980:10) to the landscape's resources in proportion to availability. There is very little storage and mainly low-bulk processing for immediate returns. The archaeological signature is a lot of small short-term residential sites with very similar, rather well-rounded, assemblages at each – high intra-assemblage variability and low inter-assemblage variability. Site distribution patterns should be rather equitably distributed in proportion to the landscape divisions. This strategy is often cited as suitable for settings that are fairly homogenous, or "fine-grained", in which spatiotemporal patchiness is low.

Conversely, collectors establish base-camps at strategic locations and send logistical parties out to the different resource areas to gather materials that are brought back to the residential base. The strategy maintains lower residential mobility, but higher mobility of small task oriented groups with specialized technology for the task at hand. There is an increased reliance on storage and high-bulk processing of resources. The archaeological signature of collectors is high visibility residential archaeological sites with substantial site furniture and a diverse tool assemblage. However, the logistical camps, which are limited to specific tasks, should reveal a rather low diversity of tool types. The net result is high inter-assemblage diversity among site types, high intra-assemblage variation within residential basecamps, but low intra-assemblage variation within logistical camps.

Based on this model, four facets of the archaeological record can be utilized to infer long-term foraging strategies in Cuatro Vientos and south Texas: 1) lithic assemblage variation; 2) site distribution patterns; 3) burned rock feature technology; and 4) resource structure.

Considerations on the Resource Structure

The region, situated on the margin of the Chihuahuan Desert, was subject to the ebb and flow of desertification. Though a clear consensus on the timing and magnitude of change has yet to be reached, environmental changes significantly affected the resource structure. In the following description of long-term foraging strategies, basic characterizations of the environment are made for each period (Table 8.1). However, a few overarching aspects of the resource structure warrant mentioning. The regional paleoenvironmental data for south Texas is rather poor and most of the following reconstructions rely on information from the Lower Pecos and Central Texas regions. Toomey et al.'s (1993) study of south central Texas vertebrate fauna is considered by many to be among the best datasets (Figure 8.1). The lack of palynological data from south Texas is the result of the poor preservational conditions such as peat bogs and dry caves (Bryant and Holloway 1985) and the local soil conditions characterized by high soil pH, low soil organic content, and poor soil drainage. Some of the interpretations on data directly from the area (such as Bousman 1990; Nordt 1998, 2000; Quigg and Cordova 2000), are either too broad-brushed (i.e. lacking much temporal resolution) to be of much utility or highly contended.

Regarding one other aspect, in worldwide models, seasonal variation or other temporal changes are often cited as primary factors in the resource structure. However, in south Texas the seasonal variation is less pronounced than in higher latitudes. As Quigg et al. (2000:27) discuss, availability of biotic resources such as prickly pear and mesquite are more affected by rains than seasons, and rainfall can be seasonally erratic. Traditional indicators of seasonality, such as growth bands on fish otoliths and mussels, dentition annuli on deer and bison, and tree ring patterns, are unreliable indicators in south Texas. This lack of distinctive seasonality has a homogenizing effect on the temporal variation of resource availability. Erratic rainfall, however, has likely always been the greatest environmental risk in long-term foraging strategies, particularly in terms of temporal availability.

One factor that is addressed throughout the following sections is the presence or absence of bison. A primary reason for the interest is their effect on the environmental resource structure in both seasonal and spatial terms. Ethnohistorical sources cite bison moving southward during parts of the year, and many groups, such as the coastal Karankawa, seasonally moved inland to exploit the herds (Ricklis 1996). Like few other resources, bison were significant enough to have formed a central economic basis of society and technology.

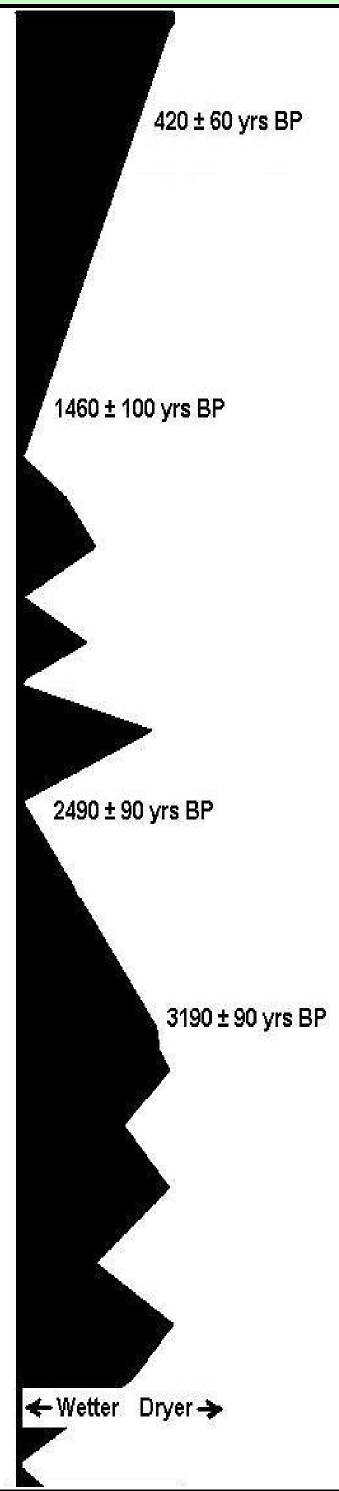
Long-Term Foraging Strategies in the Lower Rio Grande Plains

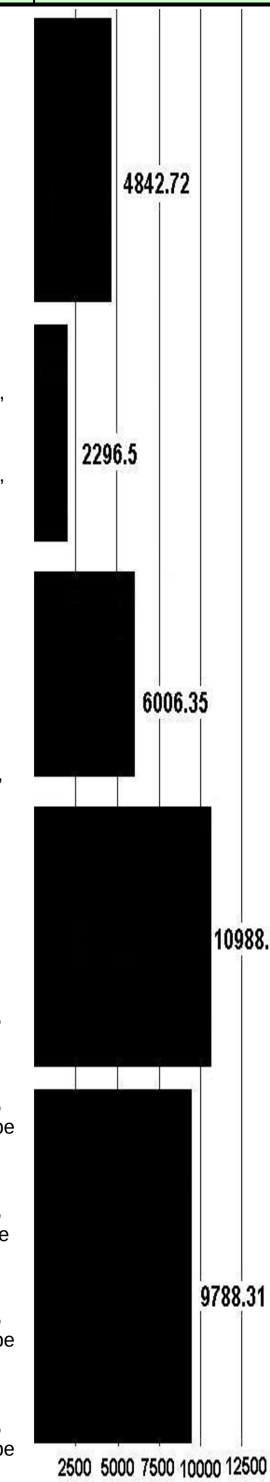
Middle Archaic - Desert Adaptation During the Altithermal

The regional data indicates the long, dry altithermal prevailed from at least 6,000 B.P. until finally dissipating around 2,500 B.P. as the setting yielded to relatively wetter conditions (Decker et al. 2000; Johnson and Goode 1994; Toomey et al. 1993). A distinctive transitional period is evident between 3,000–3,200 B.P. Bison, which are reportedly present throughout much of this era according to Dillehay (1974), become prevalent around 3,200 B.P., continuing for a millennium or so. In the Lower Pecos during the Cibola subperiod (3,150–2,300 B.P.) rock art depicting bison hunts, large quantities of bison remains, and distinctive broad-bladed projectile point styles attest to the central value of bison in subsistence economy at this time. However, the magnitude of bison presence farther south in Webb County is poorly defined, but there is some evidence that it was not a substantial economic source this far south. In the analysis of the Lino site components dating from 3,400–2,000 B.P., Quigg et al. (2000) note the common identification of deer/antelope residues on burned rock samples, but no bison. Likewise, samples from the Falcon reservoir site farther to the south did not identify evidence of bison processing. Only a Late Prehistoric sample from the Boiler site yielded organic residues consistent with bison (Quigg et al. 2002). Other aspects of the archaeological record such as broad-bladed darts points are not common in Webb County, though they are occasionally recovered.

Table 8.1. Comparative Environmental and Cultural Chronological Data

Time (B.P)	Paleoenvironmental Data: *General Setting****	Paleoenvironmental Data: *Paleoenvironmental index from Hall's Cave.(Toomey, et al. 1993:308)*	Paleoenvironmental Data: *Moisture**	Paleoenvironmental Data: *Bison*	Cultural Chronology: *Cuatro Vientos*	Cultural Chronology: *Lower Pecos (Turpin 2004)*	Cultural Chronology: *South Texas (Hester 2004)*	Cultural Chronology: *Central Texas (Collins 2004)*	Cultural Chronology: *Coastal Bend*	Formal Tools in South Texas	Average Weight of Burned Rocks from Features (in grams)****	Foraging Strategy
250	Modern climatic equivalent though slightly cooler		Dry	Prevalent	Late Prehistoric	Late Prehistoric - Infierno	Late Prehistoric	Late Prehistoric-Toyah	Rockport Phase	Perdiz		Plains-style large game oriented foraging strategy
500		420 ± 60 yrs BP	Dry	Prevalent	Late Prehistoric	Late Prehistoric - Flecha Subp.	Late Prehistoric	Late Prehistoric-Toyah	Rockport Phase	Perdiz		Plains-style large game oriented foraging strategy
750	Dry interval beginning around1000 to 750 B.P.		Dry	Occasional	Late Prehistoric	Late Prehistoric - Flecha Subp.	Late Prehistoric	Late Prehistoric	Late Prehistoric		4842.72	Continued desert adaption with technological transition allowing increased delayed return
1000			Mesic	Occasional	Late Prehistoric	Late Prehistoric - Flecha Subp.	Late Prehistoric	Late Prehistoric	Late Prehistoric	Caracara		Continued desert adaption with technological transition allowing increased delayed return
1250			Mesic	Occasional	Transitional Archaic	Late Prehistoric - Flecha Subp.	Late Prehistoric	Late Prehistoric	Late Archaic	Scallorn		Desert adaption - broad strategy, high mobility, broad diet breadth, diverse landscape use
1500		1460 ± 100 yrs BP	Mesic	Occasional	Transitional Archaic	Blue Hills	Late Archaic	Late Prehistoric	Late Archaic	Ensor, Olmos, Frio, Ellis, Fairland	2296.5	Desert adaption - broad strategy, high mobility, broad diet breadth, diverse landscape use
1750	Shift around 2500 to wetter conditions in Lower Pecos and south central Texas, possible continued grasslands but mesic mixed grassland/short grassland		Wet	Occasional	Transitional Archaic	Blue Hills	Late Archaic	Late Archaic	Late Archaic	Ensor, Olmos, Frio, Ellis, Fairland		Desert adaption - broad strategy, high mobility, broad diet breadth, diverse landscape use
2000			Wet	Occasional	Late Archaic	Blue Hills	Late Archaic	Late Archaic	Late Archaic	Shumla, Marcos, Montell		Desert adaption - broad strategy, high mobility, broad diet breadth, diverse landscape use, Marked increase in importance of fishing along coast (Ricklis 2004:165) by 2000b.p.
2250			Wet	Prevalent	Late Archaic	Blue Hills	Late Archaic	Late Archaic	Late Archaic	Shumla, Marcos, Montell	6006.35	Desert adaption - broad strategy, high mobility, broad diet breadth, diverse landscape use
2500		2490 ± 90 yrs BP	Dry**	Prevalent	late Middle Archaic	Late Archaic - Cibola	late Middle Archaic	Late Archaic	Late Archaic	Tortugas, Marshall, Montell		Plains-style large game oriented foraging strategy, bison
2750	Transitional from desert shortgrass to mixed grassland		Wet	Prevalent	late Middle Archaic	Late Archaic - Cibola	late Middle Archaic	Late Archaic	Late Archaic	Tortugas, Abasolo, Carrizo		Plains-style large game oriented foraging strategy, bison
3000			Dry	Prevalent	late Middle Archaic	Late Archaic - Cibola	late Middle Archaic	Late Archaic	Late Archaic	Tortugas, Abasolo, Carrizo	10988.34	Plains-style large game oriented foraging strategy, bison
3250		3190 ± 90 yrs BP	Dry	Prevalent	late Middle Archaic	Middle Archaic - San Felipe	Middle Archaic	Late Archaic	Middle Archaic	Langtry, Val Verde, Arenosa		Intensive collector strategy, population concentration and increase in ecological sweet spots
3500	Possibly shortgrass grasslands to desert grassland/steppe grading to Chihuahuan Desert assemblage		Dry	Ocasional	early Middle Archaic	Middle Archaic - San Felipe	Middle Archaic	Late Archaic	Middle Archaic	Langtry, Val Verde, Arenosa, Guadalupe tools		Intensive collector strategy, population concentration and increase in ecological sweet spots
3750			Dry	Ocasional	early Middle Archaic	Middle Archaic - San Felipe	Middle Archaic	Late Archaic	Middle Archaic	Langtry, Val Verde, Arenosa,Guadalupe tools		Intensive collector strategy, population concentration and increase in ecological sweet spots
4000			Dry, slight Mesic interlude	Ocasional	early Middle Archaic	Middle Archaic - San Felipe	Middle Archaic	Late Archaic	Middle Archaic	Langtry, Val Verde, Arenosa, Guadalupe tools	9788.31	Intensive collector strategy, population concentration and increase in ecological sweet spots
4250		← Wetter Dryer →			early Middle Archaic			Middle Archaic	Middle Archaic	Langtry, Val Verde, Arenosa, Guadalupe tools	2500 5000 7500 10000 12500	"Economy of scale" (Brown 1991) small highly mobile, considerable investment in processing low-risk resources





*Toomey et al. 1993; Quigg and Cordova 2000
**Bryant's (1966) Juno Interval equivalent/Toomey et al began mesic period at 2500 b.p.
***Derived from summation by Decker, et al 2000; Johnson and Goode 1994; Toomey et al 1993
**** In association with Cuatro Vientos chronology.

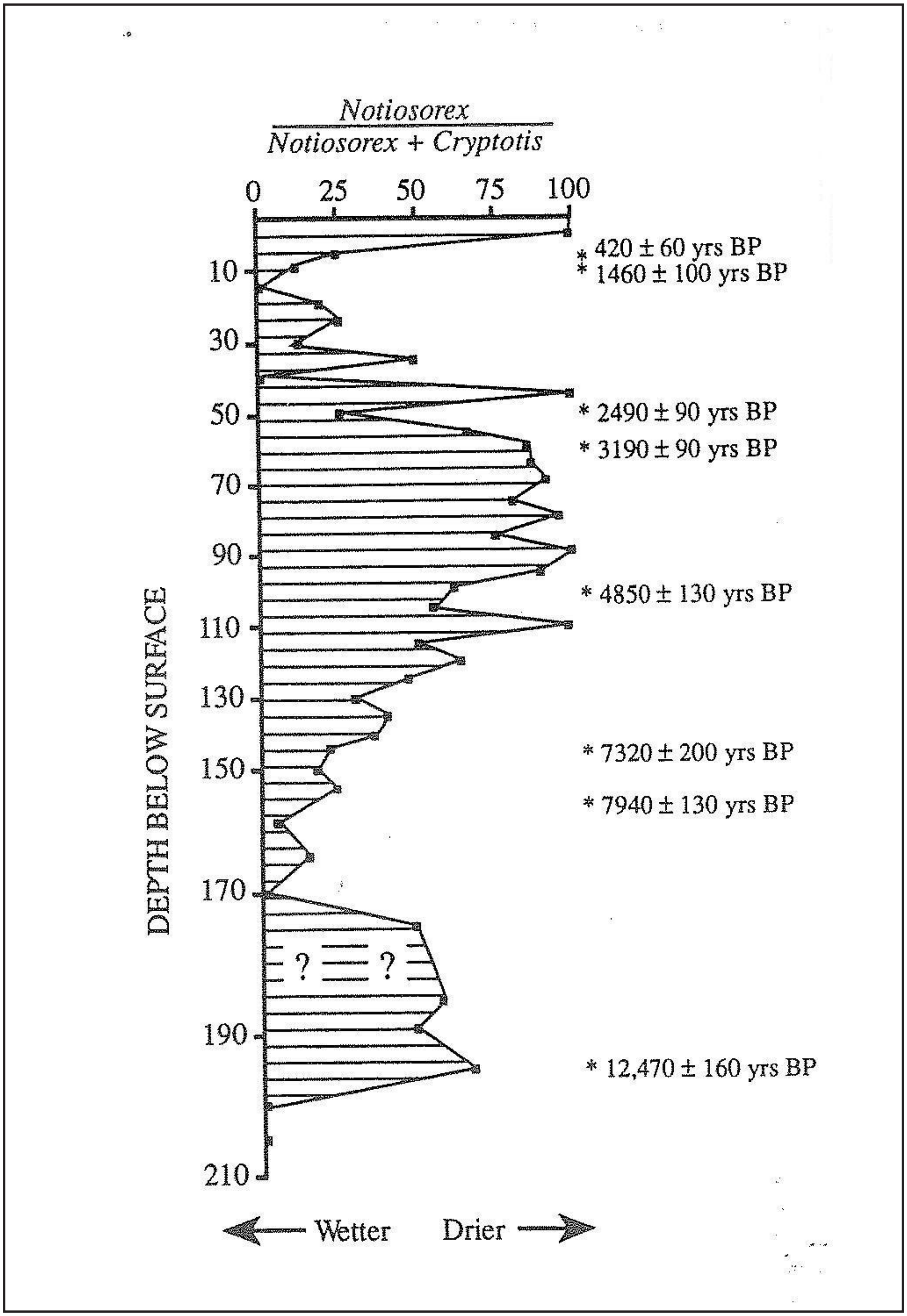


Figure 8.1. Among the most precise paleoenvironmental index in central Texas, the desert and least shrews from Halls Cave in Kerr County indicate the commonly recognized "mesic interval" from about 2,300 to roughly 1,000 B.P. Adapted from Toomey, et al (1993:308).

In a review of Webb County projectile points listed on county site forms, of the 629 projectile points, one Castroville and two Shumla points are identified (Table E.1, Appendix E), both of which belong to the following Late Archaic period. No Montell, Marcos, Marshall, or other of the types commonly associated with the bison hunters are reported. That is not to say forms such as Tortugas were not employed in bison hunting, but rather the central point types of the "tool kit" associated with bison hunting to the north was not introduced either through migration or cultural transmission to any great extent in the area.

Assemblage data from several sites was interpreted as representing fairly high inter-assemblage variation between sites in different settings. Cuatro Vientos sites 41WB623 and 41WB441 seem to have a diverse assemblage with abundant formal tools, such as Tortugas and Nueces tools, that are considered "personal gear", suggesting a residential base. Conversely, the nearby Lino site showed a relatively narrow suite of lithic tools during the late Middle Archaic, possibly indicating more of a task oriented logistical camp. The temporal resolution at the Cuatro Vientos site, however, was too poor to draw many conclusions.

In most of the adjacent regions, from about 4,000 to 2,500–2,300 B.P. or so during the Altithermal, authors have suggested a strategy characterized as a *logistical collector strategy* (Ricklis and Collins 1994 in central Texas; Dering 1999; Turpin 2004 for the Lower Pecos; and Story 1985 for the broader western Gulf Coastal Plain). In south Texas, like many of the other areas, drier conditions resulted in a depletion of upland biomass, creating a landscape with highly variable distributions of resources, principally between resource-poor uplands and rich riparian zones. Populations concentrated in optimal locations on the landscape where game or plant resources could be extensively exploited. Larger groups occupied base camps for longer periods of time, creating high-visibility sites with large cumulative features such as burned rock middens. Such a strategy would have relied on smaller, task specific groups foraying out onto the land to procure needed resources, leaving behind relatively low visibility resource procurement and short-term camps in upland areas. Their technology would have been organized accordingly, with a very high diversity of tool forms (intra-assemblage variability) in the base camps, technology ranging from the very expedient and informal to the highly formal "personal gear".

Evidence suggests the subsistence strategy in the Middle Archaic of Webb Countty was a broad-based approach with intensive processing of high-bulk, low-ranked resources such as desert succulents. Burned rock technology, namely the large feature size and formality, in this period is interpreted as reflecting the processing of sotol, agaves, and other such species. The Cuatro Vientos data is rather mute on this subject given the lack of intact or date-able features. However, the four dated features tend to coincide with the county data, which shows a high investment of energy in burned rock technology at this time.

The site distribution patterns during the Middle Archaic, not entirely distinctive, suggest a trend towards a more intensive occupation of the lower portions of the landscape during more xeric times from 4,400–2,300 B.P. Compared to other times, upland valleys and upland valleys/plains have fewer sites, while lower elevation settings such as stream terraces are relatively high. These may be focal points of critical concentrated resources where base camps were established. Uplands are utilized in proportion with their percentage of the landscape. The data is low from the early part of the period, obscuring patterns from this part of the Middle Archaic. However, archaeological visibility for the late Middle Archaic is by far the highest of any era.

Late Archaic – Transition to Mesic Interval – 2,300–1,850 B.P.

At the terminus of the Altithermal, bison appear more commonly in the archaeological record of adjacent areas, but are still poorly represented in Webb County evidence. Shumla and Castroville, often associated with bison as noted, are found in the county record, possibly suggesting a degree of reliance on bison. Of the diagnostic materials of this time, the Desmuke appears to be the style that represents technological continuity of the endemic stylistic trajectory of triangular to subtriangular forms. This time was a transition to a more generalized foraging strategy, though many of the early subsistence practices of intensive succulent processing continued.

Concurrent developments in adjacent areas include the dramatic increase in exploitation of aquatic resources, notably fish, in coastal areas by about 2,000 B.P. (Ricklis 2004:165), a return to a diversified desert adaptation in the Lower Pecos with increased mobility, broad diet breadth, widespread landscape use (Brown 1991; Turpin 2004:274), and a shift to bison as an economic mainstay in central Texas (Story 1985:50). The result of these varying strategies is the emergence of markedly different cultural patterns among the regions, some towards more intensive processing of very high ranked resources (fish and bison) and others towards a continued reliance on low-ranked sources such as desert succulents. There are several economic sources that allow for sustained intensification, including agriculture, aquatic/ maritime settings, and herd animals. In differing areas of Texas, the Late Archaic witnessed the rise of specialization around each of these resources. The evidence suggests this area of south Texas took a different direction, more along the lines of the Lower Pecos pattern of mobile foraging. The strategy was probably intermixed with the input of external influences such as bison hunting on occasion, but there is not much evidence to indicate these were long-term, sustained parts of the economy.

As a result of an amelioration in climate, the resource structure is likely to have become more equitable across the landscape, relieving some of the environmental circumscription around isolated zones of relative abundance. Specifically, with wetter times it is expected the upland carrying capacity would increase and water sources would have become more prevalent. Bison may have been occasionally present, and their primary habitat being the grasslands would have facilitated a resource structure weighted towards uplands.

Site distribution data for the Late Archaic period indicates a move up the landscape towards drainage headwaters and plains, but overall a fairly equitable exploitation of the landscape. The move up the landscape, however, appears to be a strategic ecotonal move. Whereas late Middle Archaic sites tend to be found in the highest portion of the uplands, the Late Archaic patterns indicate occupation along the headwaters at the transition between upper riparian and upland. The interpretation proposed here is a pattern of residential mobility as opposed to logistical mobility of the previous period. This interpretation is in part derived from the assemblage composition from the different times.

The burned rock feature and lithic assemblage information indicate the Late Archaic period shows a lessening of the more intensive processing strategy of earlier times. However, earlier practices continued sporadically as most clearly evident in a few large burned rock features still present on some sites. The assemblages, based on the best available evidence, seem to have high internal diversity, but possibly low inter-assemblage variation, consistent with a forager pattern.

So the distinction of this brief time period is a basic economy shift away from intensive use of low-ranked resources focusing instead on a more opportunistic and equitable resource structure, possibly using an encounter-based hunting strategy to exploit the occasional bison. From the few examples, the lithic assemblage shows high diversity of tools at foraging residential base camps (e.g. OZ 1 at the Lino site), but overall a decrease in the archaeological visibility as a result of decreased occupational redundancy. Evidence of intensive processing, such as large cumulative middens and formal groundstone, is notably less prominent than in the preceding millennia, but a degree of continuity is evident.

Transitional Archaic – Generalized Patterns

The Transitional Archaic is not widely used as a partition of the south Texas chronology, but as Hester (2004:142) notes, in areas such as Webb and LaSalle Counties, "it would be wise to use the concept of a 'terminal Archaic' for sites with Ensor, Frio, Catan, and Matamoros." From about 1,850–1,200 B.P., by most accounts the climate was wetter, bison disappeared from all but the southern Plains, and the distribution of xerophytic succulents, which are so often cited as the primary resources exploited by midden technology, receded to the south and west.

By most lines of evidence, a shift from xeric conditions to a more mesic setting that are interpreted as reducing the strongly heterogenous ecological patterns around lower riparian corridors of earlier times, resulting in a more equitable distribution of resources across the landscape. To the north in central Texas, between the riparian corridors and the higher upland areas, "a wide transitional zone composed of both arboreal and prairie elements, the well-watered eastern half of the Edwards Plateau ordinarily furnished plant and animal food resources for a moderately sized human population practicing Archaic hunting and gathering methods" (Johnson and Goode 1994:41). How far south this pattern extended is uncertain, but to a degree, however subtle, there was likely a similar effect in far southern Texas.

Conceivably, the social fabric of the times was regionally rather open to widely ranging influences. Technologically, Webb County includes Ensor and Frio points, which are found over a very wide area, but also the locally distinctive Matamoros and Catan forms. The latter styles are often considered arrow points developed from the long trajectory of south Texas triangular to subtriangular points. The advent of these forms in the Transitional Archaic coincides with the advent of the bow in large portions of North America including the Gulf Coastal Plain (Shott 1993:425).

The decrease of bison is counterintuitive since the conditions seemingly became better suited to ideal bison habitat according to many accounts. However, it seems the carrying capacity of the Plains, bison's primary habitat, increased substantially allowing a move out of marginal settings such as central and south Texas.

The record of the time reflects an increasingly strong forager strategy, an economy that exploited a relatively high-biomass setting. Higher mobility is perhaps reflected by a very low archaeological visibility in the lithic assemblage and burned rock data. As a result, the data offers only vague trends. The few burned rock features indicate a rather minimal investment in this technology, perhaps indicative of low-bulk processing.

Though the dataset is rather sparse, the site distribution patterns suggest the Transitional Archaic is a return to a more intensive occupation of the lower portions of the landscape compared to the Late Archaic, though the environmental resource structure is very different. Uplands continue to be utilized, and upland valleys and upland valleys/plains, considered collectively, show a rather consistent use, though slightly lower than the overall percentages of site components through time in this setting. However, stream flood plains and river valleys, the lower portions of the landscape show relatively higher proportions. Of all periods, the Transitional Archaic has the greatest data needs to clarify the patterns. In adjacent areas such as northeast Texas, the Southwest, Plains, to the south in Nuevo Leon Tamaulipas, and the Rio Grande Delta rather major cultural developments were emerging at this time. How and to what extent cultural influences from these other areas extended into the Lower Rio Grande Plains would contribute to a clarification of the regional setting.

Late Prehistoric

Subsequent to the Transitional Archaic, there is generally considered to be a continuity in the patterns until approximately 750–800 B.P. when very distinctive cultural identities emerge, many of which are clearly identified as those later described in the ethnohistorical record. The Brownsville Complex in the Rio Grande Delta, Toyah Complex of central and southern Texas, Rockport Phase on the coast, and other identities become evident in the archaeological record. Paleoenvironmental evidence indicates a sharp change to arid conditions at this time (Decker et al. 2000; Toomey et al. 1993).

By most accounts bison returned by about 800 B.P., but again their prominence is uncertain in far south Texas. Cabeza de Vaca indicated bison sometimes moved as far south as the Lower Guadalupe River valley (Campbell 1988:19), but a review of the Nuevo Leon ethnohistorical literature makes no reference to bison just south of Laredo (Campbell 1988:51). Such a notion has a long history of contention, however (Neck 1998:277–278). Huebner (1991), utilizing data from 77 archaeological components in southern and central Texas, identified the earliest return of bison in the Late Prehistoric at 790 B.P. after an absence of quite some time. This supports Dillehay's (1974) timing of bison presence and absence periods.

Fifteen Perdiz points, which are so often associated with bison-hunting Toyah groups, are cited in the Webb County reports (Appendix E). Other changes in tool kits emerge, notably end scrapers, well-made bifacial knives, and drills. Notably, ceramics are uncommon. There has been quite a bit of debate as to whether the advent of this suite of tools represents migration of bison-hunters from the north or diffusion of a tool kit among indigenous groups. Conceivably, there was a complex mix of different groups and different economies with a Toyah bison-based strategy interdigitating with a long, gradually evolving, indigenous desert adaptation. This evidence of Toyah indicates the subsistence economy to some degree shifted to the procurement of high-ranked resources, namely hunting of mid-sized to large game.

Site distribution data for the Late Prehistoric period indicates patterns reminiscent of the Late Archaic, a strategic ecotonal move up the landscape towards drainage headwaters and plains, but overall a fairly equitable exploitation of the landscape. While at first glance there seems to be an increased settlement of uplands, further analysis shows a focus on the headwaters at the transition between upper riparian and upland. Similar to the Late Archaic patterns, the interpretation proposed here is a pattern of residential mobility as opposed to logistical mobility of the previous period.

Subsistence information is present on a few Webb County sites, notably the Boiler site (Quigg et al. 2002). The assemblage of faunal remains from this site included 2,800 bone fragments dating to the last 1,000 years or so, roughly the Late Prehistoric. Most of the assemblage was likely from the last 500 years. The assemblage included frogs, skunks, wood rats, gophers, snakes, turtles, armadillos, deer, birds, and unidentified species that were mice and mole-sized, rabbit-sized, and raccoon-sized (Quigg et al. 2002:299-301). Some of the species may have been introduced by natural rather than cultural causes. That group of species, however, compares favorably to ethnohistorical accounts of groups in Nuevo Leon subsisting on a diverse base "deer, rabbits, rats, birds, and snakes" (Campbell 1988:51). Deer were cited as the most important game animal. Two small bison sized fragments were identified, and organic residues on rocks that dated to the period were interpreted as bison. Mussel shells were also common.

Though not abundant, the assemblage data is generally defined for the Late Prehistoric in Cuatro Vientos or the general Webb County data. Burned rock information, however, is better represented. The features are relatively small and the total weight of burned rock is lower than any of the previous periods, excluding the Transitional Archaic because of a low sample size. This pattern is consistent with a higher residential mobility and decreased focus on high-bulk, low-ranked resources.

Overall, the evidence indicates a generalized foraging strategy targeting a diversity of species, plant and animal. The archaeological signature of the time shows a decrease in the formality and size of burned rock features.

Summary

The prevailing views of south Texas long-term foraging strategies from about 4,400 to 250 years B.P. suggest a logistical collector strategy ending about 2,500–2,300 B.P., replaced by a generalized foraging strategy in the end of the Archaic and through the early Late Prehistoric. Sites during the Middle Archaic (about 4,000 to 2,500–2,300 B.P.) reflect an archaeological assemblage with relatively substantial burned rock features, formal site furniture, a high intra-assemblage lithic variation in residential base camps but low diversity in limited activity camps, high archaeological visibility, wide dietary breadth in the floral and faunal species, intensive processing of high-bulk resources, and a relative abundance of utilizable and non-exhausted raw material and tools at base camps. Discard patterns are generalized with all stages of almost all tool forms present. Residential sites are strategically located on prominences overlooking riparian zones.

Subsequent to that time, from the Late Archaic through the early Late Prehistoric, evidence suggests a shift to a more generalized forager strategy. The archaeological signature of these periods includes a significant decrease in the formality and size of burned rock features, a high intra-assemblage variability of lithic tool categories but low inter-assemblage variability among sites, less intensity of processing high bulk resources, lower overall archaeological visibility, discard patterns marked by a relative increase of late-stage, exhausted tools, and more formal tools. Site distribution patterns indicate a more equitable use of the landscape, but only to a degree – headwaters of drainages seem to be more commonly selected as site locales. During the Late to Transitional Archaic there appears to have been increasingly wide economic networks in the region. Hester (2004;142) suggest increased trade with central Texas. Likewise for central Texas, Johnson and Goode (1994) suggested large-scale ideological changes and wide social networks developed after about 2500 B.P. as evident in numerous lines of evidence such as marine shell trade and burial practices.

Towards the end of the Late Prehistoric phase, there was likely a composite social setting with the occasional intrusion of bison-oriented groups with a highly specialized economy, as well as an indigenous desert adaptation. The archaeological assemblage of the time is composed of smaller burned rock feature technology, fairly low archaeological visibility, a specialized tool kit, emphasis on high ranked resources such as deer and bison, and an equitable site distribution, but a comparably higher settlement along headwater drainages.

Chapter 9

Summary, Critique, and Directions for Future Research

One of the most arresting conclusions in considering the vagueness of the south Texas archaeological record, is that nothing certain can be said at all. Looking back over all the data presented in this report, at the highest levels of certainty, few if any statistically significant patterns emerge. Nearly all patterns in the data that were utilized in this report are only "suggestive trends". Overlapping categories, mixed assemblages, typological continuities, biases both seen and unseen, and a suite of other factors tend to undercut any statistical certainty or the isolation of variables. Such uncertainties threaten to relegate any broad statements on prehistoric patterns, such as long-term foraging strategies, to mere conjecture. However, by juxtaposing numerous lines of evidence, the cumulative picture is rather compelling. In considering the results of this effort, several critical assessments, recommendations, and conclusions are warranted.

Critical Assessment of Broad Generalizations

"Time's arrow" (Ascher 1968), the tendency towards the breakdown of structure and association, has a homogenizing affect on the archaeological record. This notion serves as a basis for a critical evaluation of some of the conclusions proposed in this report. One of the fundamental objectives was to look at change over time and develop a hypotheses of behavioral change through the cultural history. However, based on the evidence, it seems such an effort can be critiqued along several lines. For one, the cultural chronology was undoubtedly not a simple straight line of sequential events, but rather a multilinear process of numerous overlapping and interacting cultural identities or strategies.

As a hypothetical analogy borrowed from Dunnell's modeling of the Ohio Valley, Figure 9.1 depicts the rapid and widely variable resource structure of an environment. As a model, the timescale could represent any given period of time, whether micro- (such as a decade), meso- (century), or macrotime (millennium).

The solid line represents the highly variable carrying capacity of the landscape. The central dotted line is often the simple averaging effect revealed in the paleoclimatic and archaeological records as a result of the lack of resolution. Lines A through D represent varying foraging strategies that are designed to adapt to differing levels of risk.

The best data for any period show general trends, concealing the highly variable nature of physical settings and the degree of risk for any prehistoric society. In the figure, Line A perseveres through short-term stress, adapts to become something else (Line C), but finally succumbed to sustained or multiple depressions in rapid succession. Line B dies out after a few critical low points in the landscape's carrying capacity such as droughts. Line B could exemplify groups adapted to bison hunting who entered the Lower Rio Grande Plains during wetter times but emigrated out of the area when the setting changed and bison retreated. Line D represents a long-term, low level foraging strategy with a technological and social organization adapted to the greatest risks the environment presents.

In south Texas, certain lines of evidence indicate throughout the last half of the Holocene, there remained a low-level technological and social continuity (Line D) that persisted through the ebb and flow of many different cultures (Lines A through C). The triangular to subtriangular forms of Early Triangular, Tortugas, Abasolo, Refugio, Desmuke, Matamoros, Catan, Starr, Guerrero, and others may represent such a technological continuity. Through it all there was an underlying social fabric of desert adaptation that likely absorbed the influences of many societies that came and went with bison and better climatic conditions that allowed expansions of differing lifestyles. Whether migratory populations or diffusion of technocomplexes, the archaeological record indicates varying expansions of central Texas, northern Mexican, coastal, and perhaps Lower Pecos groups at differing times. The progression

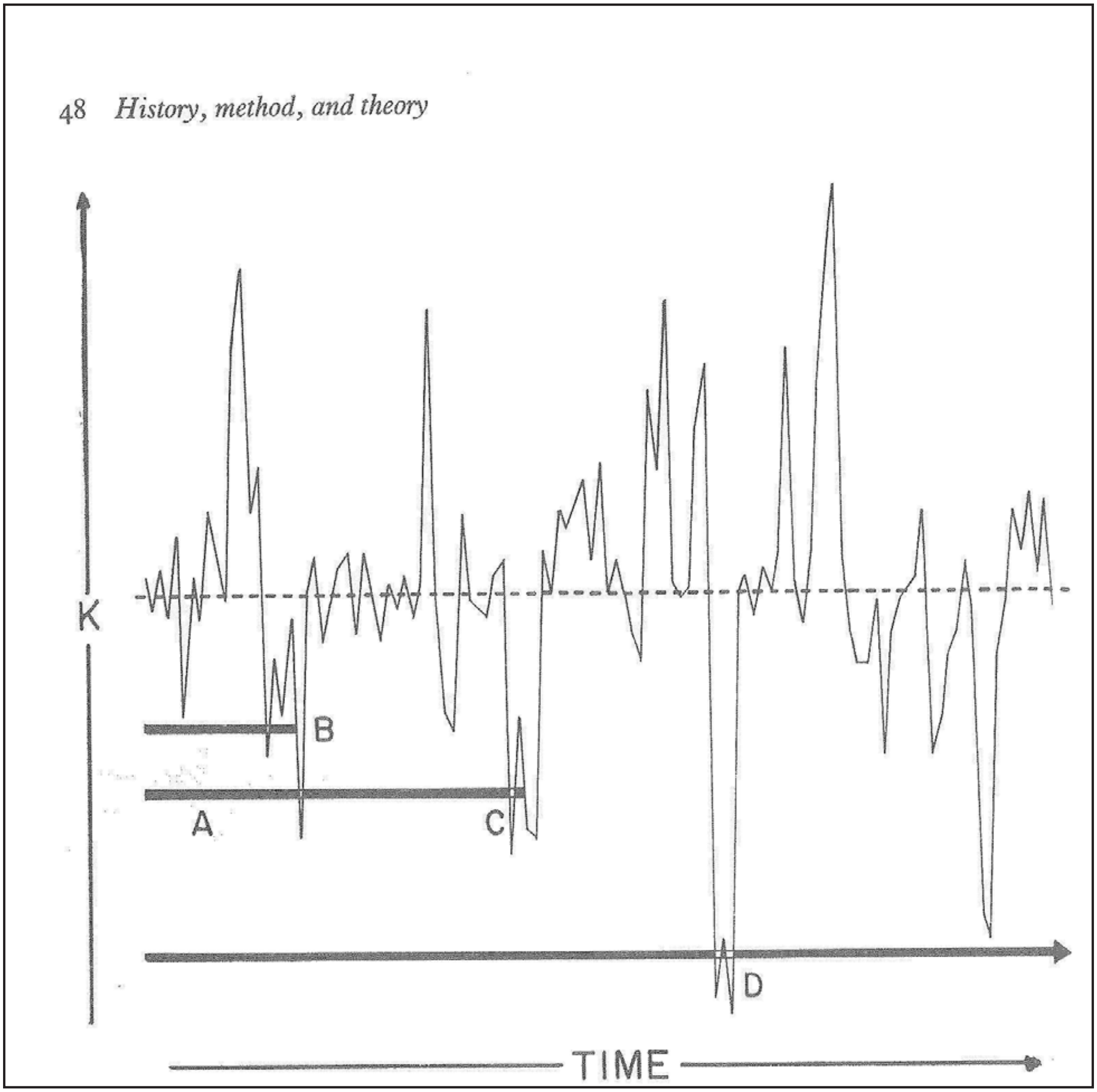


Figure 9.1. Dunnell's (1989) depiction of adaptive capabilities of different populations. The diagram is adapted here to illustrate a closely related but slightly different scenario, different foraging strategies. The solid line represents fluctuations of the settings actual carrying capacity through time. Lines A through D indicate various long-term foraging strategies. K on the left is the landscape's carrying capacity. Time is on the bottom.

of diachronic events proposed in this report can be criticized as rather simplistic relative to the actual complexity, but such a nuanced perspective needs to be approached in incremental steps.

Evolution and the "Cultural Sink"

Beneath the fluctuating influences through time, the cultural history of South Texas was underlain by an adaptive strategy that was unglamorous but evolutionarily highly successful. From a broad perspective, the cultures of south Texas maintained a rather low level of political and technological organization throughout almost its entire prehistoric chronology. By most accounts they maintained a fluid, mobile social structure subsisting on a broad suite of animal and plant sources, eating almost anything the hostile environment afforded. "The harsh realities of their savage world and life are more apt to repulse than attract" (Newcomb 1980:56-57).

Newcomb rather famously called the area a "cultural sink", a low level of cultural evolution. Researchers have often considered this term unduly derogatory, and many have taken defensive stances about the regional cultures. Nevertheless, most overviews of the regional culture history recognize the "conservative" nature of the area's record and presumed adaptive pattern (i.e. Line D). From a global perspective, it is true that populations likely remained relatively low and that the resource structure was not very conducive to intensification. Namely, many locally available resources are "low ranking" and a higher energy input would not lead to incrementally higher caloric yields. Large herd game, agriculture, and aquatic resources are all categories that are ripe for intensification and the upper Rio Grande plains have none of those. Bison perhaps arrived during certain eras, but likely in insufficient quantities to comprise an ecological mainstay. Without population increase little impetus for more complex forms of political and social organization were warranted.

These are basic characterizations. The challenge is to move beyond broad generalizations and begin to address the variation in the archaeological record. Along with the long-term underlying cultural matrix was undoubtedly quite a bit of short-lived adaptive strategies and intrusive cultures or influences that created a substantially more complex setting.

Recommendations - Fundamental Objectives and Their Feasibility

At the outset, we noted the organization of this report was designed to parallel James Deetz's structure as presented in Invitation to Archaeology, in which each chapter addressed the most basic areas of inquiry that archaeologists utilize to reconstruct the past. The report was ordered this way for several reasons, but most saliently to clearly lay out the possibilities and problems with the south Texas archaeological record. Addressing the questions relied on certain kinds of data, very specific data. The following summarize of what proved to be the vital and effective lines of evidence serve as recommendations for future investigatory approaches.

Time and Space

These parameters are the most basic aspects of archaeological inquiry. Specific recommendations for these data include

- spatial data, ideally high resolution GPS coordinates, of temporal and site structural (such as features) information
- Acquisition of radiocarbon or other absolute dates whenever feasible.
- Documentation of observed time-range of sites.
- Definition of temporally discrete components and associations.
- Documentation of temporally sensitive formal tools

Form

The forms of features and artifacts are subject to stage of reduction, erosion, and other factors. To the extent possible, measurement should account for such variables. For example, in the burned rock feature analysis, the original intent was to use diameter as an indicator of investment of labor into feature technology. However, a review of the reports revealed certain features, though comprising relatively few rocks, had large reported diameters as a result of being widely scattered. Their diameter was unreflective of the labor investment in their construction. Accordingly, the weight of the burned rock in the feature, rather than its diameter, proved to be the most valuable measurement in addressing that objective, though few studies have taken such measurements. Those studies that distinguish and measure different rock types have a potential for substantial research avenues for functional variation over time and space. Attributes of form and function often require analyses beyond what can be obtained at the survey level. Specific recommendations include:

- Weights of burned rock features if being excavated, or diameters if unexcavated.
- Documentation of artifact forms through outline drawings, referenced to spatial coordinates.

Structure

The association of archaeological materials, among themselves and to the landscape, is most often done in the field at the site level. Recognition of broader patterns of data are often most feasible through manipulations of data in labs. In the analysis of Webb County data, site centroids were often the only available spatial data on features or temporal components. For most of the history of Texas archaeology, site plotting on 7.5-minute USGS topographic maps has been an effective means of documenting sites. This information is suitable for a certain level of resolution. The Cuatro Vientos sites often transcend soil boundaries, cover various landforms, and are arbitrarily defined subdivisions of continuous artifact scatters, and consequently clear associations are often difficult to discern. The recommendation for this issue is as previously stated – high resolution spatial data on structural elements of archaeological landscapes. At the site level to regional level and beyond, such data provides quite a few possibilities in perpetuity.

Regarding interpretive recommendations, the following are proposed:

- Compile datasets for specific classes of data (such as ceramics, burned rock features, point types, burials, radiocarbon dates).
- Draw correlations among artifact classes and landscape positions
- Develop spatial distribution maps of archaeological classes
- Landscape position/soil type

Table 9.1 shows a predictive model of site locations and burial potentials for different soil types and landscape potentials. Based on the finding of the correlations of sites and soils, the distributions generate a number of hypotheses. The archaeological probabilities are defined by the number of sites recorded in the soil type relative to the soil's proportion of the landscape. If no sites have been recorded, the potential is classified as low. If the percentage of sites in a soil type is high relative to its proportion of the landscape, it is considered to have a high potential. Moderate potential is in accordance or lower than its proportion of the landscape. This model generates a number of recommendations regarding methodology, including:

- Subsurface investigation in soils with potential for buried deposits, most notably Catarina, Lagloria, Tela, and Rio Grande soils
- Intensive surficial survey of high probability uplands in Copita, Jimenez-Quemado, Maverick-Catarina, and Palafox soils with high resolution mapping.

Behavior

Inferences of behavior are often best drawn from the juxtaposition of various lines of evidence. Mitigating factors, particularly in south Texas, usually make a single class of data rather unreliable as direct indicators of larger patterns. Based on the results of the studies described herein, a contextual approach is recommended for integrated various lines of disparate data, specifically a geographic information systems (GIS) approach.

Table 9.1. Predicted Distribution of Webb County Sites by Soil Landscape Position

Soil Name	Landscape Position	Proportion of Landscape (%)	Percentage of County Sites in Soil	Archaeological Potential	If Present, Potential for Buried Deposits	Geomorphic Burial Process
AgB—Aguilares sandy clay loam, 0 to 3 percent slopes	*Upland*	5.70%	0.00%	Low	Low	Colluvial
Ar—Arroyada clay, frequently flooded	*Stream floodplains*	0.20%	0.00%	Low	High	Alluvial
Bd—Brundage fine sandy loam, occasionally flooded	*Upland valleys*	4.50%	0.00%	Low	Moderate	Alluvial/Colluvial
BrB—Brystal fine sandy loam, 0 to 3 percent slopes	*Uplands*	3.60%	4.25%	Moderate	Low	Colluvial
CaB—Catarina clay, 0 to 2 percent slopes	*Upland valleys and plains*	8.60%	4.25%	Moderate	Moderate	Alluvial/Colluvial
CfA—Catarina clay, occasionally flooded	*Upland valleys*	0.80%	1.42%	Moderate	Moderate	Alluvial/Colluvial
CoB—Comitas fine sand, 0 to 3 percent slopes	*Uplands*	0.20%	0.00%	Low	Low	Colluvial
CpB—Copita fine sandy loam, 0 to 3 percent slopes	*Uplands*	8.90%	27.83%	High	Low	Colluvial
CRB—Cuevitas-Randado complex, gently undulating	*Uplands*	2.60%	0.00%	Low	Low	Colluvial
DeB—Delfina loamy fine sand, 0 to 3 percent slopes	*Uplands*	0.50%	0.00%	Low	Low	Colluvial
DmB—Delmita loamy fine sand, 0 to 3 percent slopes	*Uplands*	0.70%	0.00%	Low	Low	Colluvial
DRB—Delmita-Randado complex, gently undulating	*Uplands*	2.70%	3.30%	Moderate	Low	Colluvial
DsB—Dilley fine sandy loam, 0 to 3 percent slopes	*Uplands*	1.10%	1.42%	Moderate	Low	Colluvial
DvB—Duval fine sandy loam, 0 to 3 percent slopes	*Uplands*	5.70%	0.47%	Moderate	Low	Colluvial
HeB—Hebbronville loamy fine sand, 0 to 2 percent slopes	*Uplands*	4.40%	0.00%	Low	Low	Colluvial
JQD—Jimenez-Quemado complex, undulating	*Uplands*	4.10%	5.66%	High	Low	Erosional-Colluvial
LgA—Lagloria silt loam, 0 to 1 percent slopes	*Stream floodplains*	1.10%	4.72%	High	High	Alluvial
LgB—Lagloria silt loam, 1 to 3 percent slopes	*Stream floodplains*	0.20%	2.36%	High	High	Alluvial
LrA—Laredo silty clay loam, rarely flooded	*Stream floodplains*	0.10%	0.00%	Low	High	Alluvial
MCE—Maverick-Catarina complex, gently rolling	*Uplands*	13.30%	17.45%	High	Low	Erosional-Colluvial
MgC—Moglia clay loam, 1 to 5 percent slopes	*Uplands*	6.40%	0.94%	Moderate	Low	Colluvial
MnB—Montell clay, saline, 0 to 2 percent slopes	*Upland valleys and plains*	9.90%	0.00%	Low	Moderate	Alluvial/Colluvial
Mo—Montell clay, occasionally flooded	*Upland valleys and plains*	1.60%	0.00%	Low	Moderate	Alluvial/Colluvial
NDF—Nido-Rock outcrop complex, hilly	*Uplands*	0.10%	2.36%	High	Low	Erosional-Colluvial
NOC—Nido Variant-Rock outcrop complex, gently undulating	*Uplands*	0.00%	0.00%	Low	Low	Erosional-Colluvial

Table 9.1. Predicted Distribution of Webb County Sites by Soil Landscape Position, continued

Soil Name	Landscape Position	Proportion of Landscape (%)	Percentage of County Sites in Soil	Archaeological Potential	If Present, Potential for Buried Deposits	Geomorphic Burial Process
NuB—Nueces fine sand, 0 to 3 percent slopes	*Uplands*	1.00%	0.00%	Low	Low	Colluvial
PaB—Palafox clay loam, 0 to 3 percent slopes	*Uplands*	3.60%	11.32%	High	Low	Colluvial
Rg—Rio Grande very fine sandy loam, occasionally flooded	*River valleys*	0.30%	0.47%	Moderate	High	Alluvial
Te—Tela sandy clay loam, frequently flooded	*Upland valleys and plains*	3.80%	7.55%	High	Moderate	Alluvial/Colluvial
To—Torriorthents, loamy-skeletal		0.00%	0.00%	Low	Low	Colluvial
VkC—Verick fine sandy loam, 1 to 5 percent slopes	*Uplands*	1.50%	4.25%	High	Moderate	Colluvial
VrB—Viboras clay, 0 to 3 percent slopes	*Uplands*	2.40%	0.00%	Low	Moderate	Colluvial
ZAC—Zapata-Rock outcrop complex, gently undulating	*Uplands*	0.30%	0.00%	Low	Low	Erosional-Colluvial
Water bodies		0.10%	0.00%	None	None	None
	Totals	***100.00%***	***100.00%***			

Geographic Information Systems-Driven Contexts

The primary problem that confronts archaeology is the lack of a clear representation of what data has been collected and from where. Interpretations and predictions are severely limited by a lack of comprehensive organization of information. Spatial information theory, used in concert with GIS has emerged in the past decade as one of more effective means of structuring data. Data, defined as "measurements of the 'real world" (Volta and Egenhofer [1998:216]), consists of *spatial*, or geographic, data and *attribute* data, sometimes referred to as *aspatial* or *non-spatial* data. A third type of data is also particularly relevant to archaeology, *temporal* data. Archaeological decision making of any sort, whether managerial, academic or otherwise, needs to know what data is present, where it is, its culturo-temporal affiliation, and whether it is still present (*data persistence*).

The data constitutes one "context". A second context is developed from the data structures, which are classes of information, as well as "hierarchies of time and space" Wigham (1998). Floriani and Magillo (1998) provide one visualization of this level of context in what they describe as landscape class hierarchies (Figure 9.2). In terms of the current study recommendations, the data on objects represents the initial context, followed by the organization of data into layers, landscape elements, and more holistic perspectives of landscapes. The second layer can be equated to a historic context for the NRHP considerations. Below this are analytical realms, theoretical or practical, that are essentially queries, such as for a particular APE or right-of-way or artifact matrices that look at correlations among types.

Historic contexts for south Texas would be substantially more effective if the issues were not the primary organizing principle of the data, but rather primary consideration was given to basic data in an amendable GIS-based system. Technology makes such an organization of data increasingly feasible in time. While the framework would need to be considered in depth, there are certain standards that could be relatively easily implemented, such as specific spatial data on structural site elements (features, for example) and critical culturo-temporal information along the lines of Figure 9.3.

In compiling such a system, there will need to be some sort of standardization of data and terminology. All comparison relies on common units of description, and patterns derive from the juxtaposition of like phenomena. Standardization does not need to impose

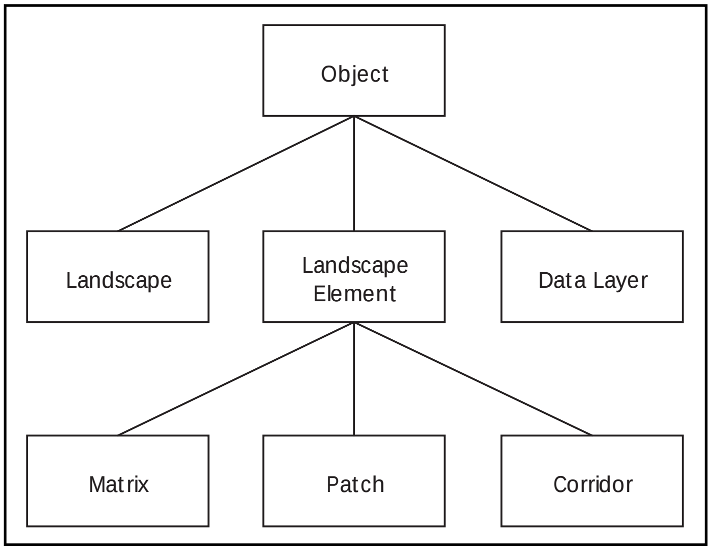


Figure 9.2. Landscape class hierarchies, adapted from Floriani and Magillo (1998).

undue classificatory burdens. An object only needs to be classified to a level of certainty. In a hierarchical system there are different layers of categories. A projectile point does not need to be pigeon-holed into pre-existent types if there is uncertainty in such determinations. If nothing else, it can be marked as belonging to the class of lithic materials.

Wikipedia and Swarm Theory

The online encyclopedia Wikipedia is often cited as the new direction, a model of collaborative contributions to develop encyclopedic knowledge. The idea behind it is that anyone can edit the content and the contributions will create continual refinements, moving ever closer to a more accurate portrayal of the prevailing level of understanding. The system openly acknowledges inevitable biases of individual contributors, but has a built in system of checks and balances by virtue of other contributors recognizing and counteracting biases of others.

The approach is somewhat similar to swarm theory, which describes aggregated decision making that yields effective outcomes for a group. Based on behavior of ants and bees but increasingly applied to society, the theory regards how a group develops “best options” from complex environments in which no individual can see the whole picture (see Figure 9.3). Based on the collective individual responses, surprisingly effective decisions are made. According to one source, “functioning in truly complex spaces moves us beyond centralized vs. decentralized debates, and puts us instead in a philosophy of simple rules, local activity, and high levels of connections/contact. The most overwhelming problems can be attended to with this simple model. The solution is not something we work on directly...instead it emerges when we attend to the individual elements.” [(http://www.elearnspace.org/blog/archives/003008.html].

Applied to the purposes of this discussion of data integration, the objectives would be to create a system of archaeological investigation whereby each individual project is incorporated into a larger system and the aggregation of effort creates a cumulative comprehension of exceedingly complex landscapes.

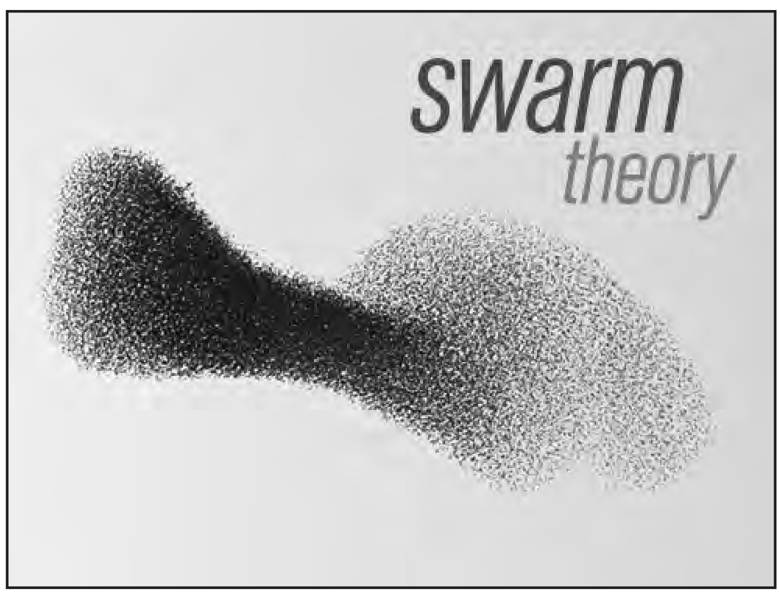


Figure 9.3. Swarm theory – a model for a GIS archaeological context. Cumulative efforts, birds in the photo, collectively contributing to complex decision making. Adapted from Miller (2007). See http://www7.nationalgeographic.com/ngm/ 0707/feature5/.

We believe GIS is an adaptable system for such organization.

A Reconsideration

There were differing opinions on the interpretive value and NRHP eligibility of the Cuatro Vientos sites. None of the seven sites were recommended by SWCA as significant, eligible for listing on the NRHP or as SALs. Generally, within the APE, the sites were found to lack integrity, have poor preservation of paleoenvironmental and subsistence data, and otherwise lack substantial and diverse material assemblages. There were areas of notable exception on a few sites, however, but the testing investigations largely recovered the data and other aspects of high research potential on the seven sites. Even in the few areas with moderately intact features or somewhat discernable activity areas, in no cases could components, occupational surfaces, or broader contexts of associated materials be defined. The lack of association, integrity, chronological segregation, preservation of organic remains, well-dated components, spatially discrete strata or activity areas – such characteristics are rather typical of south Texas sites, which are often undifferentiated archaeological landscapes with mixed surficial assemblages.

In part it was agreed that the lack of a historic context, or decent frame of reference, hampered such determinations of significance for the seven sites since it was unclear what meaningful issues there were to address in the region. Based primarily on a variety of post-depositional processes such as modern clearing, bioturbation, and erosion, the archaeological record is highly fragmented, with occasional remnants of intact areas. While some have been effective, most studies of this poorly preserved regional record have had limited results in elucidating meaningful data, let alone patterns, in prehistoric lifeways.

The common interpretive tacts that archaeologists rely upon, most notably association, is often ineffective in such a setting. Most approaches, particularly ones that emphasize discernible assemblages, isolable components, chronological and spatial separation or individual human agency, are poorly suited to derive meaningful information from many sites. The continual application of integrity as a primary criterion in determinations of significance may yield too many foregone conclusions and the undue dismissal of interpretive potential.

Accordingly, a fair amount of time on Cuatro Vientos was spent compiling archaeological data from the sites and region and developing the framework of a very preliminary historic context. The effort focused on exploring approaches that could lead to significant research avenues despite the limitations in the data. In Chapter 3, the sites were introduced and discussed in a rather standard method. SWCA's original research design was configured to address each site as an independent dataset, conducting standard analyses, and drawing conclusions that would be tied into the larger county and regional context, a rather inductive approach of moving from the particular data to broader generalizations.

However, the partial development of the historic context allowed sufficient compilation of data to identify a number of hypothetical trends that could be tested by the specific Cuatro Vientos data, allowing a more deductive approach. While it is implausible, to some degree, to compare the findings of the current approach to what would have been had the traditional tact been utilized, it is reasonable to say the historic context process greatly benefited the investigations. The research and results outlined in Chapters 5, 6, 7, and 8 of this report were developed directly from the compilation and assessment of regional data.

In regards to field methods, the question can be asked whether we would have conducted the testing work differently if we had initially been guided by a historic context or even several research questions like those explored in this report. The answer to the question is both yes and no. Yes, more attention would have likely been paid to documenting associations between artifacts and features. And dependent upon the research question asked, some techniques may have been adjusted slightly. But for the most part, the investigations were thorough enough to provide sufficient data to the studies. Utilization of a sub-meter GPS on all diagnostics and detailed documentation of features proved invaluable in the field and is recommended for all site documentation in the area.

Conclusion

This report of the Cuatro Veintos investigations established a set of three primary research issues (Nueces tools, burned rock features, settlement patterns), compiled data best suited to addressing these issues, and defined field and laboratory methods needed to acquire the requisite information. These questions, data, and methods are recommended as viable avenues to contribute to an understanding of the prehistory of the South Texas Plains.

Assessing NRHP eligibility is fundamentally intended to be considered within a context. As stated:

> To qualify for the National Register, a property must be significant.....The significance of a historic property can be judged and explained only when it is evaluated within its historic context. Historic contexts are those patterns or trends in history by which a specific occurrence, property or site is understood and its meaning (and ultimately its significance) within history or prehistory is made clear (National Park Service 1995).

The Cuatro Vientos project has attempted to construct a contextual approach that could be implemented in a GIS system in which classes of data are considered as relatively autonomous layers that form components of an archaeological culture. Data layers are individual contexts that can be considered independent of associations with other data layers. Additional layers are infinitely expandable and can include the natural environment and modern built environment such as roadways etc. Layers, contributing to an archaeological “landscape”, organize or select data within and among data, ascribing significance to certain attributes. The modern information structure and computational facilities that are widely available make such a task imminently feasible.

References

Abbott, J. T.

1997 Archaeology Testing at Sites 41WB437 and 41WB438 Webb County, Texas (draft report). Archaeology Studies Program, Enivronmental Affairs Division, Texas Department of Transportation.

Andrefsky, W., Jr.

1991 Inferring Trends in Prehistoric Settlement Behavior from Lithic Production Technology in the Southern Plains. *North American Archaeologist* 12:129–144.

Ammerman, A. J., and M. W. Feldman

1974 On the "Making" of an Assemblage of Stone Tools. *American Antiquity* 39:610–616.

Asher, R.

1968 Time's Arrow and the Archaeology of a Contemporary Community. In *Settlement Archaeology*, edited by K. C. Chang, pp. 43–52. National Press Books, Palo Alto.

Bailey, G. N.

1983 Concepts of Time in Quartenary Prehistory. *Annual Review Anthropology* 12:165–192.

Bamforth, D. B.

1986 Technological Efficiency and Tool Curation. *American Antiquity* 51:38–50.

1991 Technological Organization and Hunter-Gatherer Land Use: A California Example. *American Antiquity* 56(2):216–234.

Barnes, V. E.

1976 *Geologic Atlas of Texas: Crystal City Eagle Pass Sheet*. The University of Texas, Bureau of Economic Geology, Austin.

Bettinger, R. L., and M. A. Baumhoff

1982 The Numic Spread: Great Basin Cultures in Competition. *American Antiquity* 47(3):485–503.

Binford, L. R.

1962 Archaeology as Anthropology. *American Antiquity* 28:217–225.

1964 A Consideration of Archaeological Research Design. *American Antiquity* 29:425–441.

1977 *For Theory Building in Archaeology: Essays on Faunal Remains, Aquatic Resources, Spatial Analysis, and Systemic Modeling*. Academic Press, New York.

1978 *Nunamuit Ethnoarcheology*. Academic Press, New York.

1979 Organizational and Formation Processes: Looking at Curated Technologies. *Journal of Anthropological Research* 35:255–273.

1980 Willow Smoke and Dogs' Tails: Hunter-Gatherer Settlement Systems and Archaeological Site Formation. *American Antiquity* 45(1):4–20.

1982 The Archeology of Place. *Journal of Anthropological Archaeology* 1:5–31.

1983 *In Pursuit of the Past, Decoding the Archaeological Record*. Thames and Hudson, London and New York.

1983 *Working at Archaeology*. Academic Press, New York

1985 Researching Ambiguity: Frames of Reference and Site Structure. In *Method and Theory for Activity Area Research: An Ethnoarcheological Approach*, edited by S. Kent. Columbia University Press, New York.

Binford, L. R., and S. R. Binford,

1966 A Preliminary Analysis of Functional Variability in the Mousterian of Levallois Facies. *American Anthropologist, Recent Studies in Paleoanthropology* 68(2) Part 2:238–295.

Black, S.L.

1986 *The Clemente and Hinojosa Site, 41JW8: Toyah Horizon Campsite in Southern Texas*. Special Report 18, Center for Archaeological Research, The University of Texas at San Antonio.

1989 -is there another Black 1989)South Texas Plains. In *From the Gulf to the Rio Grande: Human Adaptation in Central, South, and Lower Pecos Texas,* by T. R. Hester, S. L. Black, D. G. Steele, B. W. Olive, A. A. Fox, K. J. Reinhard, and L. C. Bement, pp. 39–62. Arkansas Archeological Survey Research Series, No. 33, Little Rock.

Black, S. L., and D. C. Creel

1997 The Central Texas Burned Rock Midden Reconsidered. In *Hot Rock Cooking on the Greater Edwards Plateau: Four Burned Rock Middens in West Central Texas*, Volume 1, by S. L. Black, L. W. Ellis, D. G. Creel, and G. T. Goode, pp. 269–306. Studies in Archeology 22, Texas Archeological Research Laboratory, The University of Texas at Austin. Archeology Studies Program Report 2, Environmental Affairs Division, Texas Department of Transportation, Austin.

Black, S.L., L.W. Ellis, D.G. Creel, and G.T. Goode

1997 *Hot Rock Cooking on the Greater Edwards Plateau: Four Burned Rock Midden Sites in West Central Texas*. 2 vols. Studies in Archaeology 22, Texas Archaeological Research Laboratory, The University of Texas at Austin. Archaeology Studies Program Report 2, Environmental Affairs Division, Texas Department of Transportation, Austin.

Blades, B. S.

2003 End Scraper Reduction and Hunter-Gatherer Mobility. *American Antiquity* 68(1):141-156.

Bleed, P.

1986 The Optimal Design of Hunting Weapons: Maintainability or Reliability. *American Antiquity* 51:737–747.

Boldurian, A. T.

1991 Folsom Mobility and Organization of Lithic Technology: A View from Blackwater Draw, New Mexico. *Plains Anthropologist* 36:281–295.

Bordes, F.

1953 *Les Limons Quaternaires du Bassin de la Seine*. Paris

1961 *Typologie du Paleolithique Ancient et Moyen*. Bordeaux.

1968 *The Old Stone Age*. World University Library, McGraw-Hill, New York.

1978 Typological Variability in the Mousterian Layers at Pech de l'Aze I, II, and IV. *Journal of Anthropological Research* 34:181-193.

1984 *Le Paleolithique en Europe. Lecons sur le Paleolithique*. Editions de Centre National de la Recherche Scientifique, Paris.

Bourdieu, P.

1977 *Outline of a Theory of Practice*. Cambridge Press, Cambridge.

Bousman, C. B

1990 *Paleoenvironments and Human Diets. In Prehistoric Archeology and Paleoenvironments in Hidalgo and Willacy Counties, South Texas: Results of the Phase II Test Excavations*, by C. B. Bousman, S. A. Tomka, and G. L. Bailey, pp. 91–103. Reports of Investigations No. 76, Prewitt and Associates, Austin.

Brewton, J. L., F. Owens, S. Aronow, and V. E. Barnes.

1976 *Geologic Atlas of Texas: Laredo Sheet*. University of Texas, Bureau of Economic Geology, Austin.

Brown, K. M.

1991 *Prehistoric Economics of Bakers Cave: A Plan for Research. In Papers on Lower Pecos Prehistory*, edited by S. A. Turpin, pp. 87–140. Studies in Archeology 8, Texas Archeological Research Laboratory, The University of Texas at Austin.

Brown, D. O., J. T. Jones, D. Anthony, and R. Ralph

2004 *Additional Cultural Resources Survey for the Proposed Cuatro Vientos Roadway, Webb County, Texas*. Blanton & Associates Inc., Austin, Texas.

Bryant, V. M., and R. G. Holloway

1985 A Late-Quarternary Paleo-Environmental Record of Texas: An Overview of the Pollen Evidence. In *Pollen Records of the Late Quarternary North American Sediments*, edited by V. M Bryant and R. G. Holloway, pp. 39–70. American Association of Stratigraphic Palynologists Foundation, Dallas.

Butzer, K.

1982 *Archaeology as Human Ecology*. Cambridge University Press, Cambridge.

Byrd, C. L.

1971 *Origin and History of the Uvalde Gravel of Central Texas*. Baylor Geological Studies Bulletin Number 20, Waco.

Campbell, T.N. and T.J. Campbell

1981 *Historic Indian Groups of the Choke Canyon Reservoir and Surrounding Area, Southern Texas*. Choke Canyon Series 1. Center for Archeological Research, The University of Texas at San Antonio.

Campbell, T. N.

1976 Archaeological Investigations at the Morhiss Site, Victoria County, Texas, 1932–1940. In *An Archaeological Survey of Coleto Creek, Victoria and Goliad Counties, Texas*, by A. A. Fox and T.R. Hester, pp. 81–85. Archaeological Survey Report 18. Center for Archaeological Research, The University of Texas at San Antonio.

1983 The Coahuiltecans and Their Neighbors. In *Handbook of North American Indians* 10:343–358. Smithsonian Institution, Washington D. C.

Carpenter, S. and Miller, K. A.

1998 *Archeological Investigations along Portions of the Proposed Webb County/ City of Laredo Facilities Engineering Plan Project, Webb County, Texas*. Archeological Report No. 97-122, SWCA, Austin.

Clark, J. G. D.

1957 *Prehistoric Europe: The Economic Basis*. Stanford University Press, Palo Alto, California.

Clark, J. W.

1992 *Archaeological Tests on Two Prehistoric Sites on Spur 400, Webb County, Texas*. A Report Submitted to the Environmental Affairs Division, Texas Department of Transportation, Austin.

Clarkson, C.

2002 Holocene Scraper Reduction, Technological Organization and Landuse at Ingaladdi Rockshelter, Northern Australia. *Archaelogy in Oceania* 37:79–86.

Clark, J.W. and A.M. Juarez

1986 *Urban Archaeology: A Culture History of a Mexican-American Barrio in Laredo, Webb County, Texas*. Publications in Archaeology Report 31, Texas State Department of Highways and Public Transportation, Austin.

Collins, M. B.
1992 *Geoarchaeological Investigations in Significance Testing of Three Archaeological Sites in the Rachal Mine Permit Area, Webb County, Texas*. Archaeological Consultants Report No. 232. George West, Texas.

2004 Archeology in Central Texas. In *The Prehistory of Texas*, edited by T. K. Perttula, pp. 101–126. Texas A & M University Press, College Station.

Cowan, F. L.
1999 Making Sense of Flake Scatters: Lithic Technological Strategies and Mobility. *American Antiquity* 64(4): 593–607.

Cowgill, G. L.
1977 The Trouble with Significance Tests and What We Can Do About It. *American Antiquity* 42(3):350–368.

Decker, S., S. L. Black, and T. Gustavason
2000 *The Woodrow Heard Site, 41UV88: A Holocene Terrace Site in the Western Balcones Canyonlands of Southwestern Texas*. Studies in Archeology 33, Texas Archeological Research Laboratory, The University of Texas at Austin. Archeology Studies Program Report 14, Environmental Affairs Division, Texas Department of Transportation, Austin.

Deetz, J.
1967 *Invitation to Archaeology*. The Natural History Press, New York.

Dering, P
1999 Earth-Oven Plant Processing in Archaic Period Economies: An Example from a Semi-Arid Savannah in South-Central North America. *American Antiquity* 64(4):659–674.

Derrida, J.
1978 *Writing and Difference*. Translated by Alan Bass. University of Chicago Press, Chicago.

Dibble, H.L.
1984 Interpreting Typological Variation of Middle Paleolithic Scrapers: Function, Style, or Sequence of Reduction? *Journal of Field Archaeology* 11:431–436.

1987 The Interpretation of Middle Paleolithic Scraper Morphology. *American Antiquity* 52:109–117.

1988 Typological Aspects of Reduction and Intensity of Utilization of Lithic Resources in the French Mousterian. *Upper Pleistocene Prehistory of Western Eurasia*. Pp. 181-198. University of Pennsylvania, Philadelphia.

Dillehay, T. D.
1974 Late Quaternary Bison Population Changes on the Southern Plains. *Plains Anthropologist* 19(65):180–196.

Dykeman, D. D., R. H. Towner, and J. K. Feathers
2002 Correspondence in Tree-Ring and Thermoluminescence Dating: A Protohistoric Navajo Pilot Study. *American Antiquity* 67(1):145–164.

Ebert, J. I.
1992 *Distributional Archaeology*. The University of Utah Press, Salt Lake City.

Ellis, L.
1997 Chapter 3. Hot Rock Technology. In *Hot Rock Cooking on the Greater Edwards Plateau: Four Burned Rock Midden Sites in West Central Texas*. Vol. 1, by S. L. Black, L. W. Ellis, D. G. Creel, and G. T. Goode, pp. 43–81. Studies in Archaeology 22, Texas Archaeological Research Laboratory, The University of Texas at Austin. Archaeology Studies Program Report 2, Environmental Affairs Division, Texas Department of Transportation, Austin.

Flenniken, and Wilke
1989 Typology, Technology, and Chonology of Great Basin Dart Points. *American Anthropologist* 91(149-158).

Frank, A. U., and I. Campari (editors)
1993 *Spatial Information Theory*. Springer-Verlag, Germany.

Floriani, L. D. and P. Magillo
1993 Computing Visibility Maps on a Digital Terrain Model. In *Spatial Information Theory*, edited by A. U. Frank and I. Campari. Springer-Verlag, Germany.

Fox. D. E.
1979 *Archaeolofgical Investigations of Two Prehistoric Sites on the Coleto Creek Drainage, Goliad County, Texas*. Archaeological Survey Report 69. Center for Archaeological Research, The University of Texas at San Antonio.

Garner, E.
1998 Natural Deposits of the River Terraces in the Vicinity of 41WB206. In *Campfires and Coal Dust on the Rio Grande: The Archaeology and History of Laredo-Colombia Solidarity International Bridge Site Nuevo Leon, Mexico and Webb County, Texas* by A. J. McGraw and J. Thompson. Archaeology Studies Program Report No. 8, Environmental Affairs Division, Texas Department of Transportation, Austin.

Goode, G. T.
2002 *The Anthon Site: A Prehistoric Encampment in Southern Uvalde County, Texas*. Texas Department of Transportation, Environmental Affairs Division Report 38. Austin.

Gould, R. A.
1969 Subsistence Behavior Among the Western Desert Aborigines of Australia. *Oceania* 39(4):253–274.

1971 The Archaeologist as Ethnographer: A Case from the Western Desert of Australia. *World Archaelogy* 3(2):143–177.

Griffen, W. B.
1969 *Cultural Change and Shifting Populations in Central Northern Mexico*. Anthropological Papers of the University of Arizona 13. University of Arizona Press, Tuscon.

Gustavson, T. C., and M. B. Collins
1998 Geoarchaeological Investigations of Rio Grande Terrace and Flood Plain Alluvium from Amistad Dam to the Gulf of Mexico. Technical Series 49, Texas Archaeological Research Laboratory, The University of Texas at Austin. Archaeological Studies Program Report 12, Environmental Affairs Division, Texas Department of Transportation.

Hall, S.A.
1986 Late Quaternary Alluvial Chronology of the Southern Plain. *Geological Society of America, Abstracts with Programs* 18:625.

Hall, G. D., S. L. Black, and C. Graves
1982 *Archaeological Investigations at Choke Canyon Reservoir, South Texas: The Phase I Findings*. Choke Canyon Series 5, Center for Archaeolgical Research, The University of Texas at San Antonio.

Hall, G. D., T.R. Hester, and S. L. Black
1986 *The Prehistoric Sites at Choke Canyon Reservoir, Southern Texas: Results of Phase II Archaeological Investigations*. Choke Canyon Series 10. Center for Archaeological Research, The University of Texas at San Antonio.

Hester, T. R.
1971 Archeological Investigations at the La Jita Site, Uvalde County, Texas. *Bulletin of the Texas Archeological Society* 42:51–148.

1976 The Archaic of Southern Texas. In *The Texas Archaic: A Symposium*, edited by T. R. Hester, pp. 83-90. Special Report 2, Center for Archeological Research, The University of Texas at San Antonio.

1976 Belize Lithics: Forms and Functions. In *Maya Lithic Studies: Papers from the 1976 Belize Field Symposium*, edited by T. R. Hester and N. Hammond, pp. 11-19. Special Report 4, Center for Archaeological Research, The University of Texas at San Antonio.

1980 *Digging Into South Texas Prehistory*. Corona Publishing Company, San Antonio, Texas.

1981 Tradition and Diversity Among the Prehistoric Hunters and Gatherers of Southern Texas. *Plains Anthropologist* 26(92):119–128.

1995 The Prehistory of South Texas. *Bulletin of the Texas Archaeological Society* 66:427–459.

2004 The Prehistory of South Texas. In *The Prehistory of Texas*, edited by Timothy K. Perttula, pp. 127–154. Number 9. Texas A&M University, College Station.

Hester, T. R., L. D. White, and J. White

1969 Archeological Materials from the Oulline Site (41LS3) and Other Sites in LaSalle County, Texas. *Texas Journal of Science* 21(2):130-165.

Highley, C. L.

1986 *Archaeological Investigations at 41LK201, Choke Canyon Reservoir, Southern Texas*. Choke Canyon Series 11. Center for Archaeological Research, The University of Texas as San Antonio.

Hitchcock, R. K.

1987 Sedentism and Site Structure: Organizational Changes in Kalhari Basarwa Residential Locations. In *Method and Theory for Activity Area Research: An Ethnoarchaeological Approach*, edited by S. Kent, pp 374–423. Columbia University Press, New York.

Huebner, J.A.

1991 Late Prehistoric Bison Populations in Central and Southern Texas. *Plains Anthropologist* 36(137):343–358.

Ivey, J.E., T.W. Medlin, and J.D. Eaton

1977 *An Archaeological Assessment of Areas Proposed for Modification at Fort McIntosh, Webb County, Texas*. Archaeological Survey Report 32, Center for Archaeological Research, The University of Texas at San Antonio.

Jelinek, A. J.

1976 *Form, Function, and Style in Lithic Analysis. In Cultural Change and Continuity: Essays in Honor of James Bennett Griffin*, edited by C. Cleland, pp. 19–33. Academic Press, New York.

Jennings, J. D.

1963 Administration of Contract Emergency Archaeological Programs. *American Antiquity* 28:277-281.

Johnson, L

2000 *Life and Death as seen at the Bessie Cruze Site (41WM13 on the Blackland Prairie of Williamson County, Texas*. Texas Department of Transportation.

Johnson, L, and T. N. Campbell

1992 Sanan::Traces of a Previously Unknown Aboriginal Language in Colonial Coahuila and Texas. *Plains Anthropologist* 37(140):185–212.

Johnson, L., and G. T. Goode
1994 A New Try at Dating and Characterizing Holocene Climates, as well as Archeological Periods, on the Eastern Edwards Plateau. *Bulletin of the Texas Archaeological Society* 65:1–51.

Jurgens, C. J.
1993 *An Archeological Survey of Wastewater System Improvements to Serve the Larga Vista Subdivision, Webb County*. Economically Distressed Areas Program, Texas Water Development Board, Austin.

Keesing, R. M.
1974 Theories of Culture. In *Annual Review of Anthropology* 3(71–97) Palo Alto, California.

Kelly, R. L.
1983 Hunter-Gatherer Mobility Strategies. *Journal of Anthropological Research* 39(3):277–396.

1988 The Three Sides of a Biface. *American Antiquity* 53:717–734.

1992 Mobility/Sedentism: Concept, Archaeological Measures and Effects. *Annual Review of Anthropology* 21:43–66.

1995 *The Foraging Spectrum: Diversity in Hunter-Gatherer Lifeways*. Smithsonian Institution Press, Washington D. C. and London.

Kelly, R. L. and L. C. Todd
1988 Coming into the Country: Early Paleoindian Mobility and Hunting. *American Antiquity* 53:231–244.

Kennett, D. J.
1996 General Systems Theory. In *The Oxford Companion to Archaeology*, edited by B. M. Fagan, pp. 245–246. Oxford University Press, New York.

Kibler, K.
1993 *Archaeological and Geomorphological Investigations at Prehistoric Sites 41WY50 and 41WY60, Willacy County, Texas*. Reports of Investigation No. 95. Prewitt and Associates, Austin.

King, T. F.
1971 A Conflict of Values in American Archaeology. *American Antiquity* 36(3):255–262.

Krieger, A. D.
2002 *We Came Naked and Barefoot: The Journey of Cabeza de Vaca across North America*. University of Texas Press, Austin.

Kuhn, S. L.
1989 Hunter-Gatherer Foraging Organization and Strategies of Artifact Replacement and Discard. In *Experiments in Lithic Technology*, edited by D. S. Amick and R. P. Mauldin, pp. 33–47. International Series 528. British Archaeological Reports, Oxford.

1990 A Geometric Index of Reduction for Unifacial Stone Tools. *Journal of Archaeological Science* 17:583–593.

Lee, R. B.
1979 *The Dobe Kung*. Holt, Rinehart and Winston, New York.

Lee, R. B. and I. DeVore (editors)
1968 *Man the Hunter*. Aldine, Chicago.

Leroi-Gourhan, A.
1972 Annexe IV, Vocabulaire. In *Fouilles de Pincevent: Essai d'Analyse Ethnographique d'un Habitat Magdalenian*, by A. Leroi-Gourhan and M. Brezillon. CNRS, Paris.

1984 *Pincevent: Campement Magdaleńien de Chasseurs de Rennes*. Ministere de la Culture, Paris.

Lynn, W. M., D. E. Fox and N. O'Malley
1977 *Cultural Resources Survey of Choke Canyon Reservoir, Live Oak and McMullen Counties, Texas*. Archeological Survey Report 20, Office of the State Archeologist, Texas Historical Commission, Austin.

Mahoney, R. B., R. P. Mauldin, and S. Tomka
2002 *Archeological Data Recovery Excavations Along Becerra Creek (41WB556), Webb County, Texas*. Archeological Survey Report 321, Center for Archeological Research, The University of Texas at San Antonio.

Mallouf, R.J. and C. Tunnelll
1977 *An Archeological Reconnaissance in the Lower Canyons of the Rio Grande*. Archaeological Survey Report 22, Texas Historical Commission Austin.

Maslyk, P., K.W. Kibler, and R.C. Fields
1996 *Archeological Site Ttesting and Additional ArcheologicalSsurvey for the Chacon Creek Sewer Interceptor, Webb County, Texas*. Technical Report 24, Prewitt and Associates, Inc., Austin.

McDowell-Lowden, Ellis E.
1983 Fire-Cracked Rock: Preliminary Experiments to Determine its Nature and Significance in Archaeological Contexts. *The Chesopien* 21(1):20-29.

McGraw, A. J., Clark J. W., and E. A. Robbins
1991 *A Texas Legacy, The Old San Antonio Road and the Caminos Reales, A Tricentennial History, 1691–1991*. Texas Department of Transportation, Environmental Affairs Department, Austin.

McGraw, A. J. and J. Thompson
1998 *Campfires and Coal Dust on the Rio Grande: The Archaeology and History of Laredo-Colombia Solidarity International Bridge Site Nuevo Leon, Mexico and Webb County, Texas*. Archaeology Studies Program Report N 8, Environmental Affairs Division, Texas Department of Transportation, Austin.

McManamon, F. P.
1984 Discovering Sites Unseen. In *Advances in Archaeological Method and Theory* 7:233-292. Academic Press, New York.

McReynolds, M.J.
1981 *Archaeological Investigations at the Laredo Cemetery Site (41WB22), Webb County, Texas*. Reports of Investigations Number 11, Prewitt and Associates, Inc., Austin.

Meltzer, D. J.
1981 A Study of Style and Function in a Class of Tools. *Journal of Field Archaeology* 8:313–326.

Miller, K. A.
1995 *Archeological Investigations on a Proposed Wastewater Line to Service Colonia Largo Vista near Laredo, Webb County, Texas*. SWCA, Archeological Report No. 95-152, SWCA, Austin.

Miller, P.
2007 Swarm Theory. *National Geographic*. July edition. Washington D.C.

Miller, K. A., S. Carpenter, L. C. Nordt, and C. W. Ringstaff
2000 *Archaeological Investigations Along the Camino Colombia Toll Road, Webb County, Texas*. SWCA Cultural Resource Report No. 97-120, SWCA, Austin.

Miller, K. A. and B. S. Young
1997 *Archeological Investigations on the Proposed City of Rio Bravo Wastewater Project, Webb County, Texas*. Archeological Report No. 97-70, SWCA, Austin.

National Park Service
1995 How to Apply the National Register Criteria for Evaluation. U.S. Department of the Interior, National Park Service, Washington D.C.

Neck, R.
1998 Berlandier's View of South Texas. In *A Texas Legacy, The Old San Antonio Road and The Camino Reales*, edited by A. J. McGraw, J. W. Clark, and E. A. Robbins, pp 269–281. Environmental Affairs Division, Texas Department of Transportation, Austin.

Nelson, M. C.
1991 The Study of Technological Organization. In *Archaeological Method and Theory*, Vol. 3, edited by M. B. Schiffer, pp. 57–100. University of Arizona Press, Tuscon.

Newcomb
1980 *The Indians of Texas*. University of Texas Press, Austin.

Nordt, L. C.
1998 Geoarchaeology of the Rio Grande and Elm Creek in the Vicinity of Site 41MV120. In *41MV120: A Stratified Late Archaic Site in Maverick County, Texas*, by B. J. Vierra, pp. 43–77. Archaeological Survey Report 251. Center for Archaeological Research, The University of Texas at San Antonio.

2000 *Late Quaternary Stratigraphy and Geoarchaeology in Archaeological Investigations Along the Camino Colombia Toll Road, Webb County, Texas*. SWCA Cultural Resource Report No. 97-120. SWCA, Austin.

Nunley, P., and T. R. Hester
1975 *An Assessment of Archaeological Resources in Portions of Starr County, Texas*. Archaeological Survey Report No. 7, Center for Archaeological Research, The University of Texas at San Antonio.

Parry, W. J., and R. L. Kelly
1986 Expedient Core Technology and Sedentism. In *The Organization of Core Technology*, edited by J. K. Johnson and C. A. Morrow, pp. 285–304. Westview Press, Boulder, Colorado.

Prewitt, E. R.
1976 *Late Archaic Occupations at the Loeve-Fox Site, Williamson County, Texas*. Research Report No. 49, Texas Archaeological Survey, Austin.

1981 Cultural Chronology in Central Texas. *Bulletin of the Texas Archeological Society* 52:65–89.

Quigg, J. M. and C. Cordova
1997 *Laredo Economically Distressed Areas Program: An Archeological and Geomorphological Investigation, Webb County, Texas*. Interim Report,TRC Mariah Associates, Inc., Austin.

Quigg, J. M., C. Lintz, G. Smith, and S. Wilcox
2000 *The Lino Site: A Stratified Late Archaic Campsite in a Terrace of San Ildefonso Creek, Webb County, Southern Texas*. TRC Mariah Associates, Inc., Austin.

Quigg, J. M., S. Pritchard, and G. Smith
2002 *The Boiler Site: Utilization of an Upland Setting over the Last 4200 Years, Webb County, Texas*. TRC Technical Report 27277, TRC Mariah Associates, Inc., Austin.

Ralph, R., D. O. Brown, J. T. Jones, and D. Anthony
2001 *Cultural Resources Survey of the Proposed Cuatro Vientos Roadway, Webb County, Texas*. Blanton & Associates Inc., Austin.

Ricklis, R. A.

1990 A Historical Cultural Ecology of the Karankawan Indians of the Central Texas Ciast: A Case Study in the Roots of Adaptive Change. Ph.D. dissertation, Department of Geography, The University of Texas at Austin.

1995 Prehistoric Occupation of the Central and Lower Texas Coast: A Regional Overview. *Bulletin of the Texas Archaeological Society* 66:265-300.

1996 *The Karankawa Indians of the Texas Coast: An Ecological Study of Cultural Tradition and Change*. University of Texas Press, Austin.

2004 *The Prehistory of Texas*. Texas A & M University Press, College Station.

Ricklis, R. A., and M.B. Collins

1994 *Archaic and Late Prehistoric Human Ecology in the Middle Onion Creek Valley, Hays County, Texas*. Studies in Archeology 19, Texas Archeological Research Laboratory, The University of Texas at Austin.

Ringstaff, C. W., D. O. Brown, and J. T. Jones

2004 *Cultural Resources Survey of the Proposed Cuatro Vientos Roadway Right-of-Way Expansion, Webb County, Texas*. Blanton & Associates Inc., Austin.

Robinson, D. G.

1995 *Upland Sites in the Middle Nueces Zone: Testing in the San Miguel Lignite Mines, Atascosa County, Texas*. Archaeological Report No. 1, Borderlands Archaeological Research Unit, The University of Texas at Austin.

Rolland, N., and H. L. Dibble

1990 A New Synthesis of Middle Paleolithic Variability. *American Antiquity* 55(3):480–499.

Ruecking, F. H.

1953 The Economic System of the Coahuiltecan Indians of Southern Texas and Northeastern Mexico. *Texas Journal of Science* 5(4):480–497.

1955a The Social Organization of the Coahuiltecan Indians of Southern Texas and Northeastern Mexico. *Texas Journal of Science* 7(4):357–388.

1955b The Coahuiltecan Indians of Southern Texas and Northeastern Mexico. Unpublished M. A. Thesis, The University of Texas, Austin.

Sánchez, J.

1992 From El Paso to Eagle Pass: Spanish Entradas along the Lower Rio Grande in the Sixteenth and Seventeenth Centuries. *Bulletin of the Texas Archeological Society* 63:53–66.

Sanders, R. R. and W. J. Gabriel

1985 *Soil Survey of Webb County, Texas*. U.S. Department of Agriculture-Soil Conservation Service. U.S. Government Printing Office, Washington, D.C.

Schiffer, M. B.

1972 Archaeological Context and Systemic Context. *American Antiquity* 37:156–165.

1976 *Behavioral Archeology*. Academic Press, New York.

1995 Behavioral Archaeology: First Principles. *Foundations of Archaeological Inquiry*. University of Utah Press, Salt Lake City.

Schiffer, M. B., and J. M. Skibo

1997 The Explanation of Artifact Variability. *American Antiquity* 62(1):27–50.

Shafer, H. J. and E. P. Baxter

1975 *An Archeological Survey of the Lignite Project, Atascosa and McMullen Counties, Texas*. Anthropology Laboratory Report 7. Texas A&M University, College Station.

Shennan, S.
1988 *Quantifying Archaeology*. Academic Press, San Diego, California.

Shiner, J. L.
1983 Large Springs and Early American Indians. *Plains Anthropologist* 29:1–7.

Shott, M. J.
1986 Technological Organization and Settlement Mobility: An Ethnographic Examination. *Journal of Anthropological Research* 42:15–51.

1989 On Tool-Class Use Lives and the Formation of Archaeological Assemblages. *American Antiquity* 54:9–30.

1993 Spears, Darts, and Arrows: Late Woodland Hunting Techiniques in the Upper Ohio Valley. *American Antiquity* 58(3):425–443.

Smith, C. S. and L. M. McNees
1999 Facilities and Hunter-Gatherer Long-Term Land Use Patterns: An Example from Southwest Wyoming. *American Antiquity* 64 (1): 117–136

Soil Survey Staff
1996 *Keys to Soil Taxonomy*. 7th edition. U.S. Department of Agriculture Natural Resource Conservation Service, Lincoln, NE.

Soil Survey Staff
1975 *Soil Taxonomy: A Basic System of Soil Classification for Making and Interpreting Soil Surveys*. U.S. Department of Agriculture Soil Conservation Service, Handbook 436. U.S. Government Printing Office, Washington, D. C.

Soil Survey Division Staff
1993 *Soil Survey Manual*. U.S. Department of Agriculture Handbook 18. U.S. Government Printing Press, Washington, D. C.

Stafford, C. R.
1994 Structural Changes in Archaic Landscape Use in the Dissected Uplands of Southwestern Indiana. *American Antiquity* 59(2):219–237.

Steward, J. H.
1936 The Economic and Social Basis of Primitive Bands. In *Essays in Anthropology Presented to Alfred Louis Kroeber*, edited by R. H. Lowie, pp. 331–350. University of California Press, Berkeley.

1955 *Theory of Culture Change*. University of Illinois Press, Urbana.

Story, D. A.
1985 Adaptive Strategies of Archaic Cultures of the West Gulf Coastal Plain. In *Prehistoric Food Production in North America*, edited by R. I. Ford, pp. 19–56. Anthropological Papers 75. University of Michigan, Ann Arbor.

Suhm, D. A., A. Krieger, and E. Jelks.
1954 An Introductory Handbook of Texas Archeology. *Bulletin of the Texas Archeological Society* 25.

Sullivan,, A. P.
1992 Investigating the Archaeological Consequences of Short-Duration Occupations. *American Antiquity* 57(1):99–115.

Taylor, A. J, and C. L. Highley
1995 *Archaeological Investigations at the Loma Sandia Site (41LK28):A Prehistoric Cemetery and Campsite in Live Oak County, Texas*. Studies in Archeology 20, Texas Archeological Research Laboratory, University of Texas at Austin.

Testart, A.
1982 The Significance of Food Storage Among Hunter-Gatherers. *Current Anthropology* 23:523–537.

Thoms, A. V.
1984 Environment, Archeology, and Land Use Patterns in the Middle Kootenai River Valley. Volume 1. In *Cultural Resources Investigations for Libby Reservoir, Lincoln County, Northwest Montana*. Project Report No. 2, Center for Northwest Anthropology, Washington State University, Pullman.

1986 Hot Rocks: The Short-Term Storage of Energy in the Calispell Valley. In *Calispell Valley Archaeological Project, Interim Report for 1984 and 1985 Field Seasons*, edited by A. V. Thoms and G. C. Burtchard. Center for Northwest Anthropology, Washington State University, Pullman.

Tomka, S. A.
2001 The Effect of Processing Requirements on Reduction Strategies and Tool Form: A New Perspective. In *Lithic Debitage, Context, Form, Meaning*, edited by W. Andrefsky, Jr., pp. 207–233. The University of Utah Press, Salt Lake City

Toomey, R. S.
1993 Late Pleistocene and Holocene Faunal Changes at Hall's Cave, Kerr County, Texas. Unpublished Ph.D. Dissertation, The University of Texas at Austin.

Toomey, R. S., M. D. Blum, and S. Valastro, Jr.
1993 Late Quaternary Climates and Environments of the Edwards Plateau, Texas. *Global and Planetary Change* 7:299-320.

Torrence, R.
1983 Time Budgeting and Hunter-Gatherer Technology. In *Hunter-Gatherer Economy Prehistory: A European Perspective*, edited by G. Bailey, pp. 11–22. Cambridge University Press, New York.

Turner, and Hester
1985 *A Field Guide to the Stone Artifacts of Texas*. 1st Ed. Gulf Publishing, Houston.

1993 *A Field Guide to the Stone Artifacts of Texas*. 2nd Ed. Gulf Publishing, Houston.

1997 *A Field Guide to the Stone Artifacts of Texas*. 3rd Ed. Gulf Publishing, Houston

1999 *A Field Guide to the Stone Artifacts of Texas*. 4rd Ed. Gulf Publishing, Houston

Treece, A. C.
1993 *A Cultural Resource Survey of the Proposed Laredo State University Campus, Webb County, Texas*. Mariah and Associates, Inc. Austin.

Trigger, B. G.
1967 Settlement Archaeology. Its Goals and Promise. *American Antiquity* 32(2):149-160.

1968 *Beyond History: The Methods of Prehistory*. Holt, Rinehart and Winston, New York.

Turpin, S.A.
1991 Time Out of Mind: The Radiocarbon Chronology of the Lower Pecos River Region. *Papers on Lower Pecos Prehistory*. Studies in Archeology 8, Texas Archeological Research Laboratory, The University of Texas at Austin.

2004 The Lower Pecos River Region of Texas and Northern Mexico. In *The Prehistory of Texas*, edited by T.K. Perttula, pp. 266–282. Texas A & M University Press, College Station.

Volta, G. S. and M. J. Egenhofer
1998 Interaction with GIS Attribute Data Based on Categorical Coverage. In *Spatial Information Theory*, edited by A. U. Frank and I. Campari. Springer-Verlag, Germany.

Warren, J. E.
1986a *A Cultural Resource Survey of the City of Laredo's Highway 359 Sanitary Landfill Project, Webb County, Texas*. Report No. 140.

1986b *Los Quemados: Archeological Testing at the Highway 359 Sanitary Landfill in Laredo, Webb County, Texas*. Archeological Consultants Report No. 143.

1989 *An Archaeological Context for the Lower Rio Grande Laterals Archeological Region of Southern Texas and Northeastern Mexico*. Report 185. Archeology Consultants, George West, Texas.

1992a *Significance Testing of Three Archeological Sites in the Rachel Mine Permit Area, Webb County, Texas*. Archaeological Consultants Report Number 284. George West, Texas Report No. 232.

1992b A Cultural Resources Survey of Lake Casa Blanca State Park, Webb County, Texas. Archaeological Consultants Report Number 284. George West, Texas.

1993 The Cigarroa Park Archaeological Project. Archaeological Consultants Report No. 351. George West, Texas.

1994 *Subsurface Testing Portions of Archaeological Sites 41WB362 and 41WB363, Texas A&M International University Campus, Webb County, Texas*. Archaeological Consultants Report No. 390. George West, Texas.

Weir, F. A.

1976 *The Central Texas Archaic*. Unpublished Ph.D. dissertation, Department of Anthropology, Washington State University, Pullman. University Microfilms, Ann Arbor.

Wigham, P.A.

1998 Hierachies of Space and Time. In *Spatial Information Theory,* edited by Frank, A. U. and I. Campari Springer-Verlag.

Willey, G.R., and P. Phillips

1958 *Method and Theory in American Archaeology*. Chicago: University of Chicago Press.

Winterhalder, B. and E. A. Smith (editors)

1981 *Hunter-Gatherer Foraging Strategies*. University of Chicago Press.

Yellen, J. E.

1977 *Archaeological Approaches to the Present: Models for Reconstructing the Past*. Academic Press, New York.

Appendix A
General Methodology

APPENDIX A

GENERAL METHODOLOGY

Several investigation methods were utilized for the archaeological test excavations on seven prehistoric sites and intensive pedestrian survey of the 48 acres of new proposed right-of-way located within the Cuatro Vientos Road project area. The general methodology used in these investigations is described below.

For documentation purposes, each site was treated as a separate investigation. Accordingly, numbering of features, artifacts, and excavation units were numbered by site rather than consecutively through the seven sites.

LAYOUT OF EXCAVATIONS AND MAPPING

Prior to excavations, site datums were established for each site, forming the arbitrary horizontal and vertical datum. Excavations were oriented north-south unless circumstances warranted otherwise. Horizontal provenience was maintained by the 1-m^2 unit, which was either be arbitrarily designated or established though a site grid. The vertical datums were given arbitrary elevations of 100.00 m for each site, and secondary datums were established as needed with elevations figured relative to the main datum. Finer point plottings were recorded by measuring from the north and east walls of the respective excavation unit. Vertical provenience was documented relative to the site datums, which was a 20-inch long, ½-inch diameter iron rebar pounded to ground level. Stringline datums were established for excavation units, blocks, trenches, and other pertinent features.

At several of the Cuatro Vientos sites, detailed mapping of artifacts, features, and their spatial relationships was a primary means of assessing the sites' nature and ability to answer research questions posed above. SWCA utilized both a standard transit and Trimble Pro-XRS TSC1 GPS Data logger capable of sub-meter accuracy at sites to develop site maps. The locations of all excavations, natural and cultural features, diagnostic tools, and other relevant phenomena (i.e., modern disturbances) at each site were carefully mapped. These maps were tied into the TxDOT base maps and stations and provided accurate planning and assessment.

SURFACE COLLECTING

Surface collection units were established at sites to obtain a sample of site surface materials for further study. Each unit measured 10 square meters (3.16-x-3.16 m). The purpose of these units was to systematically collect surficial data that could potentially yield information on behavior. The utilization of these units is tied directly to TxDOT's research module prepared by Scott Pletka, Ph.D. regarding researching upland sites in the Laredo area. Collection units were established around all surficial diagnostic artifacts found on each site, a select number of burned rock features, any lithic reduction features, and randomly in other portions of each site to provide comparative data. Collection units may provide important data in site setting such as those on Cuatro Vientos. All artifacts in each unit were collected and bagged by provenience for analysis in the laboratory. At times a shovel was used to scrape the surface of the unit to collect all artifacts. Any dirt resulting from this scraping was screened through ¼-inch mesh. Formal tools and diagnostics were point provenienced in each collection unit.

SHOVEL TESTING

In the 48-acres of new project right-of-way to be explored at the northern end of the project area, SWCA primarily employed shovel testing. Shovel tests were excavated to 1 m below ground surface or until pre-cultural substrate was encountered. The tests were excavated with a standard round or square-headed shovel until sterile stratum was reached. All fill from each shovel test was screened through ¼-inch wire mesh to insure full artifact retrieval. The locations of each shovel test were precisely mapped and all artifacts found in shovel tests were analyzed in the field and returned to the test prior to backfilling.

BACKHOE TRENCHING

Several sites warranted subsurface exploration with a backhoe to attain depths unreachable by shovel testing techniques. In addition, the geomorphological study required abundant subsurface exposures across the project area to properly assess the landscape and depositional settings. As such, backhoe trenching was utilized extensively in the project area. An experienced archaeologist monitored all trenching while excavations were underway. Once each trench was excavated, it was examined by an archaeologist and the geoarchaeologist, who aided in the interpretation of soils, cultural deposits, archaeological potential, and site significance. Detailed soil descriptions were recorded for each trench by an experienced archaeologist and/or the geoarchaeologist. All features encountered during trenching were mapped and photographed. In addition, a column of soil was excavated and screened down one side of select trenches. The columns were roughly 40-x-40-cm in size, extending from the ground surface to the base of the trench. Soil from the column was removed in 20-cm levels and screened through ¼-inch hardware screen mesh. The artifacts from each column sample were quantified and recorded in the field, but only tools and diagnostic artifacts were collected. The entire process was thoroughly photo documented. Hand unit excavations were conducted off the sides of trenches, as described below, to explore exposed features or cultural components. All trenches were backfilled and leveled upon completion of excavation and recording.

HAND EXCAVATIONS

Hand unit excavations were focused on features or important, intact cultural deposits to aid in assessing site contents, structure, and integrity. Using standard archaeological methods, test units were systematically excavated in arbitrary 10-cm levels and documented using standardized field forms and photographs. All soils were screened through ¼-inch wire mesh, and feature fill will be fine-screened in the lab through ⅛-inch mesh or smaller. All artifacts and pertinent faunal or floral remains or samples were collected for analysis. Features encountered during the investigations were carefully exposed, documented, and excavated. SWCA exclusively used individual 1-x-1-m units, as no occasion arose that would warrant excavation in blocks.

The layout of excavations was guided by the location of potentially significant features. On a number of sites, no significant features were identified in the available surface exposures. Therefore, the location of test units was determined by the identification of features in trench profiles or cutbanks.

FEATURE DOCUMENTATION

Analysis of burned rock features in intact, buried contexts is critical to fully understand this widely used prehistoric technology in the region. Each feature discovered during hand excavations was numbered consecutively by site, and all features were exposed in plan view, drawn, and photographed. Each feature was thoroughly documented, cross-sectioned, sampled, and recovered. Detailed coarse (burned rock) and fine matrix analyses were conducted, detailing the types, counts, and characteristics of the matrices. Feature matrix was collected and returned to the laboratory for further processing. This matrix was floated and used for other special samples such as pollens or phytoliths.

SPECIAL SAMPLING STRATEGY

In conjunction with the excavations, special samples were systematically collected from appropriate contexts across the sites. Special samples included materials for radiocarbon dating (from features, geomorphic units, and other appropriate contexts, with AMS dating to be used when necessary), matrix samples for flotation and/or fine screening (features and systematic column samples across site), and possibly pollen/phytolith samples (features and systematic retrieval from site and controls), to aid in paleoenvironmental reconstruction. These types of samples are often critical in determining a site's significance and are a common component in site testing.

Radiocarbon dating was judgementally used for absolute dating of strata, components, features, and artifact types. C_{14} chronometric dates were run on materials deemed to have sufficient association and integrity to contribute to the interpretation of the sites. All radiocarbon samples were corrected for sources of error and all correction factors used will be detailed in the report. At the request of the Project Geomorphologist, soil humate samples were taken from certain contexts to aid in dating soil stratigraphy. In addition to the radiocarbon dating, SWCA processed flotation and pollen/phytolith samples to explore site preservation potential and potential data yield in regards to paleoenvironmental reconstruction or subsistence. Macrobotanical and pollen/phytolith sampling was limited to feature contexts. No samples of any kind have been processed to date.

ARTIFACT COLLECTION

All artifacts and samples recovered from each provenience unit (whether test unit, backhoe, or collection unit) were collected, bagged, and labeled accordingly. Burned rock was returned to the SWCA labs for analysis but will not be curated.

ANALYSIS AND REPORTING

Following completion of the testing investigations, SWCA prepared this interim report on the investigations for review by TxDOT and the THC. Upon approval by the relevant agencies, the complete analysis and full report of the investigations will be accomplished under a separate work authorization. However, Texas Antiquities Permit 3755 will cover the production of the final report and curation related to the project. Once all of the analyses have been completed, a full draft report of the results will be produced. The archaeological report of the investigations will conform to Antiquities Code of Texas, Council of Texas Archaeologists, and National Historic Preservation Act standards. The report will include a brief description of the history of the transportation project and the consultation between agencies under Section 106, and will document previous investigations in the area a well as the background cultural and environmental settings. It will include the results of the field investigations specific to each of the seven sites, and describe the analytical techniques and methodologies that were used. It will also include a report of results of artifact and other analyses. The final report will contain recommendations of site eligibility and characterize site integrity and archaeological content within the context of the research design.

Once complete, the full draft final report will be submitted to TxDOT for review. Upon approval of the draft final report, a final report will be produced and submitted to TxDOT. Per requirements of the Texas Antiquities Code, TxDOT will submit 20 copies of the final report copies to the THC.

CURATION

Per Texas Antiquities Code guidelines, all documents and any artifacts recovered from sites discovered during the investigations will be curated at an approved curatorial facility. In the case of the Cuatro Vientos project, following the completion of SWCA's analyses, all artifacts recovered during the investigations will be submitted to TxDOT, which will assume responsibility for curation.

Appendix B
Pollen Analysis for Sites 41WB441 and 41WB578

POLLEN ANALYSIS FOR SITES 41WB441 AND 41WB578, TEXAS

By

Linda Scott Cummings

With Assistance from
R. A. Varney

Paleo Research Institute, Inc.
Golden, Colorado

Paleo Research Institute Technical Report 07-76

Prepared For

SWCA Environmental Consultants
Austin, Texas

September 2007

INTRODUCTION

Two pollen samples from two sites within the Cuatro Vientos project area south of Laredo in Webb County, Texas were examined. These samples represent features described as an intact rock-lined hearth and a distinct burned rock cluster.

METHODS

Pollen

A chemical extraction technique based on flotation is the standard preparation technique used in this laboratory for the removal of the pollen from the large volume of sand, silt, and clay with which they are mixed. This particular process was developed for extraction of pollen from soils where preservation has been less than ideal and pollen density is lower than in peat.

Hydrochloric acid (10%) is used to remove calcium carbonates present in the soil, after which the samples are screened through 150 micron mesh. The samples are rinsed until neutral by adding water, letting the samples stand for 2 hours, then pouring off the supernatant. A small quantity of sodium hexametaphosphate is added to each sample once it reaches neutrality, then the samples are allowed to settle according to Stoke's Law in settling columns. This process is repeated with ethylenediaminetetraacetic acid (EDTA). These steps remove clay prior to heavy liquid separation. The samples are then freeze dried. Sodium polytungstate (SPT), with a density 1.8, is used for the flotation process. The samples are mixed with SPT and centrifuged at 1500 rpm for 10 minutes to separate organic from inorganic remains. The supernatant containing pollen and organic remains is decanted. Sodium polytungstate is again added to the inorganic fraction to repeat the separation process. The supernatant is decanted into the same tube as the supernatant from the first separation. This supernatant is then centrifuged at 1500 rpm for 10 minutes to allow any silica remaining to be separated from the organics. Following this, the supernatant is decanted into a 50 ml conical tube and diluted with distilled water. These samples are centrifuged at 3000 rpm to concentrate the organic fraction in the bottom of the tube. After rinsing the pollen-rich organic fraction obtained by this separation, all samples receive a short (20-30 minute) treatment in hot hydrofluoric acid to remove any remaining inorganic particles. The samples are then acetolated for 3-5 minutes to remove any extraneous organic matter.

A light microscope is used to count the pollen to a total of approximately 100 to 200 pollen grains at a magnification of 500x. Pollen preservation in these samples varied from good to poor. Comparative reference material collected at the Intermountain Herbarium at Utah State University and the University of Colorado Herbarium was used to identify the pollen to the family, genus, and species level, where possible.

Pollen aggregates are clumps of a single type of pollen, and may be interpreted to represent pollen dispersal over short distances, or the introduction of portions of the plant represented into an archaeological setting. No aggregates were observed in these samples. Pollen diagrams are produced using Tilia, which was developed by Dr. Eric Grimm of the Illinois State Museum. Total pollen concentrations are calculated in Tilia using the quantity of sample processed in cubic centimeters (cc), the quantity of exotics (spores) added to the sample, the quantity of exotics counted, and the total pollen counted and expressed as pollen per cc of sediment.

Indeterminate pollen includes pollen grains that are folded, mutilated, and otherwise distorted beyond recognition. These grains are included in the total pollen count, as they are part of the pollen record. The charcoal frequency registers the relationship between pollen and charcoal. The total number of microscopic charcoal fragments was divided by the pollen sum, resulting in a charcoal frequency that reflects the quantity of charcoal observed, normalized per 100 pollen grains.

Pollen analysis also includes examination for and identification of starch granules to general categories, if they are present. Starch granules are a plant's mechanism for storing carbohydrates. Starches are found in numerous seeds, as well as in starchy roots and tubers. The primary categories of starches include the following: with or without visible hila, hilum centric or eccentric, hila patterns (dot, cracked, elongated), and shape of starch (angular, ellipse, circular, eccentric). Some of these starch categories are typical of specific plants, while others are more common and tend to occur in many different types of plants.

ETHNOBOTANIC REVIEW

It is a commonly accepted practice in archaeological studies to reference ethnographically documented plant uses as indicators of possible or even probable plant uses in prehistoric times. The ethnobotanic literature provides evidence for the exploitation of numerous plants in historic times, both by broad categories and by specific example. Evidence for exploitation from numerous sources can suggest a widespread utilization and strengthens the possibility that the same or similar resources were used in prehistoric times. Ethnographic sources outside the study area have been consulted to permit a more exhaustive review of potential uses for each plant. Ethnographic sources document that with some plants, the historic use was developed and carried from the past. A plant with medicinal qualities very likely was discovered in prehistoric times and the usage persisted into historic times. There is, however, likely to have been a loss of knowledge concerning the utilization of plant resources as cultures moved from subsistence to agricultural economies and/or were introduced to European foods during the historic period. The ethnobotanic literature serves only as a guide indicating that the potential for utilization existed in prehistoric times--not as conclusive evidence that the resources were used. Pollen and macrofloral remains, when compared with the material culture (artifacts and features) recovered by the archaeologists, can become indicators of use. Plants represented by pollen will be discussed in the following paragraphs in order to provide an ethnobotanic background for discussing the remains.

Native Plants

Opuntia (Prickly Pear Cactus)

Opuntia (prickly pear, Indian fig) is the most widespread cactus in the United States. All species produce edible fruit, often called tunas. The fruits were eaten raw, stewed, or dried for winter use. Young stems or pads were peeled and eaten raw or roasted. The seeds were eaten in soups, or dried, parched, and ground into a meal to be used in gruel or cakes. The peeled pads were used as a dressing on wounds, and a tea made from the pads was used to treat lung ailments. Juice from the fruit was applied to warts (Foster and Duke 1990:88). Indians used a tea made from the fruits of *O. lindheimeri* (Texas prickly pear) to treat ailments caused by gallstones. Prickly pear cactus are perennials found throughout the western United States on arid, rocky, or sandy soils (Burlage 1968:21; Harrington 1964:382-384; Kirk 1975:50-52; Loughmiller and Loughmiller 1994:31-35; Medsger 1966:61; Muenscher 1980:317).

Poaceae (Grass Family)

Members of the Poaceae (grass) family have been widely used as a food resource. Grass grains were normally parched and ground into a meal to make various mushes and cakes Young shoots and leaves were cooked as greens. Grass also is reported to have been used as a floor covering. Some species of grass were used medicinally. *Andropogon glomeratus* (bushy bluestem) was used by the Catawba Indians to treat backache. *Hordeum jubatum* (foxtail barley) is used as an eye medicine. A decoction of *Oryza sativa* (rice) is used in fevers and inflammatory infections of the stomach, lungs, and kidneys. Paiute Indians gave sugar from *Phragmites communis* (common reed) to people with pneumonia. This plant also has been used as a diuretic, depurient, and an emetic. Grass seeds ripen from spring to fall, depending on the species, providing a long-term available resource (Burlage 1968:81-85; Chamberlin 1964:372; Harrington 1967:322).

DISCUSSION

Sites 41WB441 and 41WB578 are located within the drainage basin of San Idelfonso Creek, which is a tributary of the Rio Grande in south Texas.

41WB441

This prehistoric site is located in the uplands on the drainage divide between Chacon Creek to the north and San Idelfonso Creek to the south. Cultural materials included a light surficial scatter of lithic debris and burned rock. A pollen sample was collected from fill of Feature 1, an intact rock-lined hearth with an apparent slight basin-shaped morphology (Table 1). The diameters of the rock fill averaged 5-10 cm. No charcoal staining or other organic debris was noted. There is no known cultural affiliation for this feature. The pollen record exhibits moderate to moderately large quantities of High-spine Asteraceae, Low-spine Asteraceae, Poaceae, and *Pinus* pollen (Figure 1, Table 2), reflecting various members of the sunflower family, grasses, and pine. In addition, small quantities of *Prosopis*, *Artemisia*, Brassicaceae, Cheno-am, *Ephedra torreyana*-type, *Eriogonum*, *Euphorbia*, Onagraceae, *Opuntia*, Poaceae, Rosaceae, and *Sphaeralcea* pollen reflect local growth of mesquite, sagebrush, a member of the mustard family, Cheno-ams, Mormon tea, wild buckwheat, spurge, a member of the evening primrose family, prickly pear cactus, grasses, a member of the rose family, and globe mallow. The pollen record suggests the possibility that grasses and perhaps prickly pear cactus were processed in this feature. All of the pollen in this sample was well deteriorated, which is consistent with use of a hearth.

41WB578

This large, prehistoric, open campsite and lithic procurement site is located in the flood plain and adjacent ridge along the south bank of the San Idelfonso Creek. Vegetation varies with elevation. The flood plain supports an over story with a thick, low grass cover, while the ridge supports semi-open arid vegetation. Feature 2, a distinct burned rock cluster, displayed an ovate pattern. No charcoal or soil staining was observed. A pollen sample was collected beneath the feature and all of the burned rock was collected.

The pollen record exhibits many of the same pollen as noted in sample 1 from 41WB441. The quantity of High-spine Asteraceae pollen is much larger in this sample, reflecting local growth of members of the sunflower family. This sample also exhibited an elevated *Opuntia* pollen frequency. Most of the *Opuntia* pollen was fragmentary, which is consistent with processing, such as grinding with ground stone. This feature appears to have been used to roast prickly pear cactus. The fragmentary nature of the prickly pear cactus pollen suggests that some portion of the prickly pear cactus, including flower parts, which implies fruit, was ground.

The burned rock collected at this site might be valuable for FTIR analysis. This analysis relies on a solvent extraction that removes lipids for identification. Separation of animal and plant lipids is usually possible, and occasionally the resulting matches with library items are specific to type of plant or animal.

SUMMARY AND CONCLUSIONS

The pollen record from two pits suggests processing grass seeds and possibly prickly pear cactus in the hearth at 41WB441 and prickly pear cactus at 41WB578. The fragmentary prickly pear pollen noted at 41WB578 suggests processing prickly pear cactus using ground stone.

TABLE 1
PROVENIENCE DATA FOR SAMPLES FROM SITES 41WB441 & 41WB578

Site No.	Feature No.	FS No.	Lot No.	Unit No.	Level No.	Depth (cmbs)	Provenience/ Description	Analysis
41WB441	1	7	12	1	5	40-50	Fill, intact, rock-lined hearth, south bisect	Pollen
41WB578	2	97	21	4	3	20-30 30-40?	Below feature, distinct burned rock cluster	Pollen

TABLE 2
POLLEN TYPES OBSERVED IN SAMPLES FROM SITES 41WB441 & 41WB578

Scientific Name	Common Name
ARBOREAL POLLEN:	
Juniperus	Juniper
Pinus	Pine
Pinus edulis	Pinyon pine
Pinus ponderosa	Ponderosa pine
Pseudotsuga	Douglas-fir
Tsuga	Hemlock
Pinus	Pine
Prosopis	Mesquite
Quercus	Oak
Asteraceae:	Sunflower family
Artemisia	Sagebrush
Low-spine	Includes ragweed, cocklebur, sumpweed
High-spine	Includes aster, rabbitbrush, snakeweed, sunflower, etc.
Brassicaceae	Mustard family
Cheno-am	Includes the goosefoot family and amaranth
Ephedra torreyana-type (includes *E. torreyana*, *E. trifurca*, and *E. antisyphilitica*)	Ephedra, Jointfir, Mormon tea
Eriogonum	Wild buckwheat
Euphorbia	Spurge
Onagraceae	Evening primrose family
Opuntia	Prickly pear cactus
Plantago	Plantain
Poaceae	Grass family
Polygalaceae:	Milkwort family
Rosaceae:	Rose family
Sphaeralcea	Globe mallow
Indeterminate	Too badly deteriorated to identify
Lycopodium cernuum	Creeping Clubmoss

Table 2 (Continued)

Scientific Name	Common Name
Macroscopic charcoal	Microscopic pieces of charcoal
Total pollen concentration	Quantity of pollen per cubic centimeter (cc) of sediment

REFERENCES CITED

Burlage, Henry M.
1968 *Index of Plants of Texas with Reputed Medicinal and Poisonous Properties*. Henry M. Burlage, Austin Texas.

Chamberlin, Ralph V.
1964 The Ethnobotany of the Gosiute Indians of Utah. In *American Anthropological Association Memoirs 2*, pp. 329-405. Kraus Reprint Corp., New York, New York.

Foster, Steven and James A. Duke
1990 *A Field Guide to Medicinal Plants*. Houghton Mifflin Company, Boston, Massachusetts.

Harrington, H. D.
1964 *Manual of the Plants of Colorado*. Sage Books, Chicago.

Harrington, H. D.
1967 *Edible Native Plants of the Rocky Mountains*. University of New Mexico Press, Albuquerque, New Mexico.

Kirk, Donald R.
1975 *Wild Edible Plants of Western North America*. Naturegraph Publishers, Happy Camp, California.

Loughmiller, Campbell and Lyn Loughmiller
1994 *Texas Wildflowers*. University of Texas Press, Austin, Texas.

Medsger, Oliver Perry
1966 *Edible Wild Plants*. MacMillan Publishing Company, Inc., Racine, Wisconsin.

Muenscher, Walter Conrad
1980 *Weeds*. 2nd ed. Comstock, Ithaca, New York.

Appendix C
Macrobotanical Analysis

APPENDIX C

MACROBOTANICAL ANALYSIS

Dr. Leslie Bush

Five flotation samples from the Cuatro Vientos project were submitted for macrobotanical analysis by SWCA Environmental Consultants. The samples represented 13.5 liters of feature matrix from three sites: three samples from site 41WB441 (9.0 liters), and one each from sites 41WB577 (1.5 liters) and 41WB578 (3.0 liters).

The Cuatro Vientos project area is located in southwestern Webb County, in what are now the outskirts of Laredo, Texas. Sites 41WB577 and WB578 span opposite sides of San Idelfonso Creek, while 41WB441 lies approximately 500 meters north of the other sites. Ecologically, the area is part of the Tamaulipan Biotic Province, which is characterized by shrubs and thorny brush (Blair 1950). Although climate fluctuations during the Holocene have resulted in variation in temperature and moisture regimes, the general character of the area is unlikely to have changed radically. Typical vegetation in historic times has included includes honey mesquite (*Prosopis glandulosa*), various acacias (*Acacia* spp.), granjeno (*Celtis pallida*), guayacan (aka Texas lignum vitae; *Guajacum angustifolia* syn. *Porlieria angustifolia*), cenizo (aka Texas barometer bush; *Leucophyllum frutescens*), whitebrush (*Aloysia gratissima*), prickly pear and tasajillo (*Opuntia* spp.), condalias (*Condalia* spp.), and goatbush (*Castela erecta*). Grasses are also important, especially in the western part of the Tamaulipan Biotic Province, where decreasing moisture results in a thinning of the woody vegetation. Most of the characteristic species noted above were recorded by archaeological investigators at Cuatro Vientos (Ralph et al. 2001; Brown and Jones 2004; Quigg 1997). Creosote bush (*Larrea tridentata*) and Spanish Dagger (*Yucca* sp.) are also mentioned at 41WB441, and more mesic species such as willows (*Salix* spp.) and cattail (*Typha* sp.) were noted by investigators as present in permanently marshy ground near sites 41WB577 and 41WB578. These marshy areas appear to owe their current existence to embankments across San Idelfonso Creek, which dam the drainage in more than one place. San Idelfonso Creek flows into the Rio Grande/Bravo approximately four kilometers to the southwest of the two sites. Soils are sandy loams and sandy clay loams of various derivations. All three sites discussed in this report have been disturbed by root plowing and/or brush clearing in the recent past. Site 41WB577 has been impacted by bovid activities during its recent use as pasture.

The sites are interpreted as prehistoric campsites and lithic reduction areas of unknown ages. Abasolo points were collected from site 41WB577, indicating some occupation(s) date to the Early or Middle Archaic (Turner and Hester 1993). No cultural materials were associated with the four features from which macrobotanical samples were analyzed.

LABORATORY METHODS

Flotation samples were processed at the SWCA Austin facilities by the bucket-to-bucket flotation method, which is a combination of bucket flotation and fine water-screening. Because the screens used are so fine (0.5 mm), it is unlikely that significant quantities of botanical remains were lost during processing even when they recovered in the heavy fraction. Light fractions from the three sites consisted largely of rootlets and other modern vegetation, while heavy fractions contained rocks and what little charcoal was present in the samples. Both light and heavy fractions were sorted according to modified standard procedures at the Macrobotanical Analysis laboratory in Manchaca, Texas (Pearsall 2000). Each flotation sample was weighed on an Ohaus Scout II 200 x 0.01 g electronic balance before being size-sorted through a stack of graduated geologic mesh. Materials that did not pass through the 2 mm x 2 mm mesh were completely sorted, and all carbonized botanical remains were counted, weighed, recorded, and labeled. Uncarbonized botanical material > 2 mm (usually rootlets) was weighed, recorded, and labeled as "contamination". Materials that fell through the 2 mm mesh ("residue") were examined under a stereoscopic microscope at 7-45 x magnification for carbonized botanical remains. Although standard procedures call for removing only wood charcoal greater than 2 mm, so little material was present in the Cuatro Vientos samples that smaller wood charcoal was also removed from residue. It was bagged and recorded separated from the larger wood charcoal. Other carbonized plant material consisted only of a small bulb fragment from site 41WB577 and two indeterminable fragments from site 41WB441. Partially carbonized wood tissue recovered from Feature 3 at site 41WB441 was treated in the same manner as wood charcoal, although it is interpreted as modern. Other uncarbonized macrobotanical remains were recorded on a presence/absence basis on laboratory forms. Finally, an unknown material recovered from two features was bagged, labeled, and recorded in the same manner the carbonized macrobotanical remains, even though it is not fully carbonized and is most likely animal (insectival) in origin.

Wood charcoal fragments were snapped to reveal a transverse section and examined under a stereoscopic microscope at 28-180 X magnification. When necessary, tangential or radial sections were examined for ray seriation, presence of spiral thickenings, types and sizes of intervessel pitting, and other minute characteristics that can only be seen at the higher magnifications of this range. Use of magnifications beyond 40 x has not been standard practice in macrobotanical analysis until recently. It is, however, the standard practice in forestry laboratories because of the increased precision it allows in the identification of many woods.

Botanical materials were identified to the lowest possible taxonomic level by comparison to materials in the Macrobotanical Analysis comparative collection and through the use of standard reference works (e.g., Core et al. 1979; Davis 1993; Hoadley 1990; Martin and Barkley 1961; Panshin and de Zeeuw 1980). Because standard wood anatomy texts focus on commercial timber species, the Inside Wood database was particularly helpful for information on the anatomy of shrubby species typical of South Texas (Inside Wood 2004-onwards). Plant nomenclature follows that of the United States Department of Agriculture Natural Resources Conservation Service Database (USDA-NCRS 2003).

RESULTS AND DISCUSSION

Identifications of macrobotanical material and indicators of disturbance are given in Tables B.1 and B.2. Table B.1 presents counts and weights of the carbonized and semi-carbonized macrobotanical remains as well as the unknown, probably insectival material. Table B.2 shows uncarbonized plant parts and other indicators of disturbance on a presence/absence basis.

41WB441

Feature 1 was roughly basin-shaped, rock-lined hearth that originated 39-40 cm below surface. Although no carbonized botanical materials were noted in the field, wood charcoal was recovered from both flotation samples taken from the feature. The wood was identifiable only to the general category of ring-porous hardwood. Pore size was medium to large, and rays were at least two-seriate. The wood charcoal tended to split in radial sections, so larger ray width is probable. The wood charcoal morphology is consistent with wood of mesquite or the acacias but not willow or members of the Verbenaceae such as whitebrush.

Feature 3 was a charcoal and ash stain initially interpreted as probable discard from a hearth feature. It contained no burned rock or debitage and had the shallowest origination depth of any feature discussed here, 27 cm below surface. Wood charcoal recovered from the feature was identifiable as one of the acacias (acacia, whitethorn, catclaw, etc.). Feature 3 also contained wood tissue that was not fully carbonized, some of which was identifiable as an acacia. The remainder of the uncarbonized wood could not be identified except as hardwood. Because Feature 3 originated close to the modern surface, well within the active soil zone, and because the site has experienced considerable disturbance originating at the modern surface, it is unlikely that uncarbonized plant remains in the feature could have survived for long periods of time. Uncarbonized macrobotanical remains from Feature 3 are probably historic in origin and likely modern. Because the carbonized macrobotanical remains are consistent with the uncarbonized remains, the possibility that these are also of recent origin must be considered. The feature may represent a modern burning event.

Other uncarbonized macrobotanical remains from the site support the interpretation that Feature 3 plant remains are recent. As shown in Table B.2 and Figure B.1, the small flotation sample from Feature 3 contained not only the highest number of uncarbonized plant taxa per liter but also the highest absolute number of uncarbonized plant taxa. The feature contains more modern plants than any other and no plants that can be securely assigned to a prehistoric cultural occupation.

41WB577

Feature 1 consisted of a burned rock cluster in which charcoal flecking was evident in the field. The feature also contained debitage. Only one small fragment of wood charcoal was recovered in the flotation sample. This sample also yielded a small fragment of bulb tissue that weighed less than one hundredth of a gram. The fragment was not identifiable except as a bulb. Wild onion or garlic, which is known along streams of the South Texas Plains, would be a good candidate, however.

41WB578

Feature 2 was a burned rock cluster that originated at a depth of 90 cm below surface. It contained no carbonized plant remains. Despite its great depth, the feature was heavily impacted by water and other disturbances, and the uncarbonized plants recovered (rootlets and an indeterminable seed) are not interpreted as ancient.

SUMMARY

Very few ancient macrobotanical remains were recovered from Cuatro Vientos project samples. Ancient plants recovered consisted of wood charcoal and a single bulb fragment from Feature 1 at site 41WB577. The very limited data available are consistent with the cooking and heating features with which they are associated.

REFERENCES CITED

Blair, W. F.
1950 The Biotic Provinces of Texas. *Texas Journal of Science* 2(1):93-117.

Brown, D., and T. Jones
2004 TexSite Site Survey Form, 2004-02-06. Texas Archeological Sites Atlas, accessed 8/27/07.

Core, H. A., W. A. Cote, and A. C. Day
1979 *Wood Structure and Identification.* Syracuse University Press.

Davis, L. W.
1993 *Weed Seeds of the Great Plains: A Handbook for Identification*. University Press of Kansas, Lawrence.

Hoadley, R. B.
1990 Identifying Wood: Accurate Results with Simple Tools. The Taunton Press, Newtown, Connecticut.

InsideWood
2004-onwards InsideWood database. http://insidewood/lib.ncsu.edu/search, accessed 8/22/07.

Martin, A. C., and W. D. Barkley
1961 *Seed Identification Manual*. University of California Press, Berkeley.

Panshin, A. J., and C. de Zeeuw
1980 Textbook of Wood Technology: Structure, Identification, Properties, and Uses of the Commercial Woods of the United States and Canada. Fourth ed. McGraw-Hill Book Company, New York.

Pearsall, D. M.
2000 *Paleoethnobotany: A Handbook of Procedures*. 2nd ed. Academic Press, San Diego.

Quigg, M.
1997 TexSite Site Survey Form, 1997-02-14. Texas Archeological Sites Atlas, accessed 8/27/07.

Ralph, R., T. Jones, and J. Smart
2001 TexSite Site Survey Form, 2001-05-28. Texas Archeological Sites Atlas, accessed 8/27/07.

Turner, E. S., and T. R. Hester
1993 *A Field Guide to Stone Artifacts of Texas Indians*. Texas Monthly Field Guide Series. Second edition. Gulf Publishing Company.

USDA, NCRS (United States Department of Agriculture, National Conservation Research Service)
2007 The PLANTS Database. http://plants.udsa.gov. Last updated 8/7/07. Accessed 8/28/07.

Appendix D
Radiocarbon Dating Results

FROM: Darden Hood, Director (mailto:mailto:dhood@radiocarbon.com)
(This is a copy of the letter being mailed. Invoices/receipts follow only by mail.)

November 15, 2006

Dr. James Abbott
Texas Department of Transportation
Cultural Resource Management
Environmental Affairs Division
125 East 11th Street
Austin, TX 78701
USA

RE: Radiocarbon Dating Results For Samples 41WB441-LOT8, 41WB441LOT26, 41WB441LOT27, 41WB577LOT9, 41WB578LOT5

Dear Jim:

Enclosed are the radiocarbon dating results for five samples recently sent to us. They each provided plenty of carbon for accurate measurements and all the analyses proceeded normally. As usual, the method of analysis is listed on the report with the results and calibration data is provided where applicable.

As always, no students or intern researchers who would necessarily be distracted with other obligations and priorities were used in the analyses. We analyzed them with the combined attention of our entire professional staff.

If you have specific questions about the analyses, please contact us. We are always available to answer your questions.

Our invoice is enclosed. Please, forward it to the appropriate officer or send VISA charge authorization. Thank you. As always, if you have any questions or would like to discuss the results, don't hesitate to contact me.

Sincerely,

Darden Hood

Dr. James Abbott | Report Date: 11/15/2006

Texas Department of Transportation | Material Received: 10/11/2006

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age(*)
Beta - 222162	2260 +/- 40 BP	-21.4 o/oo	2320 +/- 40 BP

SAMPLE : 41WB441-LOT8
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (organic sediment): acid washes
2 SIGMA CALIBRATION : Cal BC 410 to 360 (Cal BP 2360 to 2320)

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age(*)
Beta - 222163	340 +/- 40 BP	-21.7 o/oo	390 +/- 40 BP

SAMPLE : 41WB441LOT26
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (organic sediment): acid washes
2 SIGMA CALIBRATION : Cal AD 1430 to 1530 (Cal BP 520 to 420) AND Cal AD 1550 to 1630 (Cal BP 400 to 320)

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age(*)
Beta - 222164	470 +/- 40 BP	-27.2 o/oo	430 +/- 40 BP

SAMPLE : 41WB441LOT27
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (organic sediment): acid/alkali/acid
2 SIGMA CALIBRATION : Cal AD 1420 to 1510 (Cal BP 530 to 440) AND Cal AD 1600 to 1620 (Cal BP 350 to 330)

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age(*)
Beta - 222165	1610 +/- 40 BP	-21.3 o/oo	1670 +/- 40 BP

SAMPLE : 41WB577LOT9
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (organic sediment): acid washes
2 SIGMA CALIBRATION : Cal AD 260 to 440 (Cal BP 1690 to 1510)

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age(*)
Beta - 222166	4080 +/- 50 BP	-20.7 o/oo	4150 +/- 50 BP

SAMPLE : 41WB578LOT5
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (organic sediment): acid washes
2 SIGMA CALIBRATION : Cal BC 2890 to 2580 (Cal BP 4840 to 4520)

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-21.4:lab. mult=1)

Laboratory number: **Beta-222162**

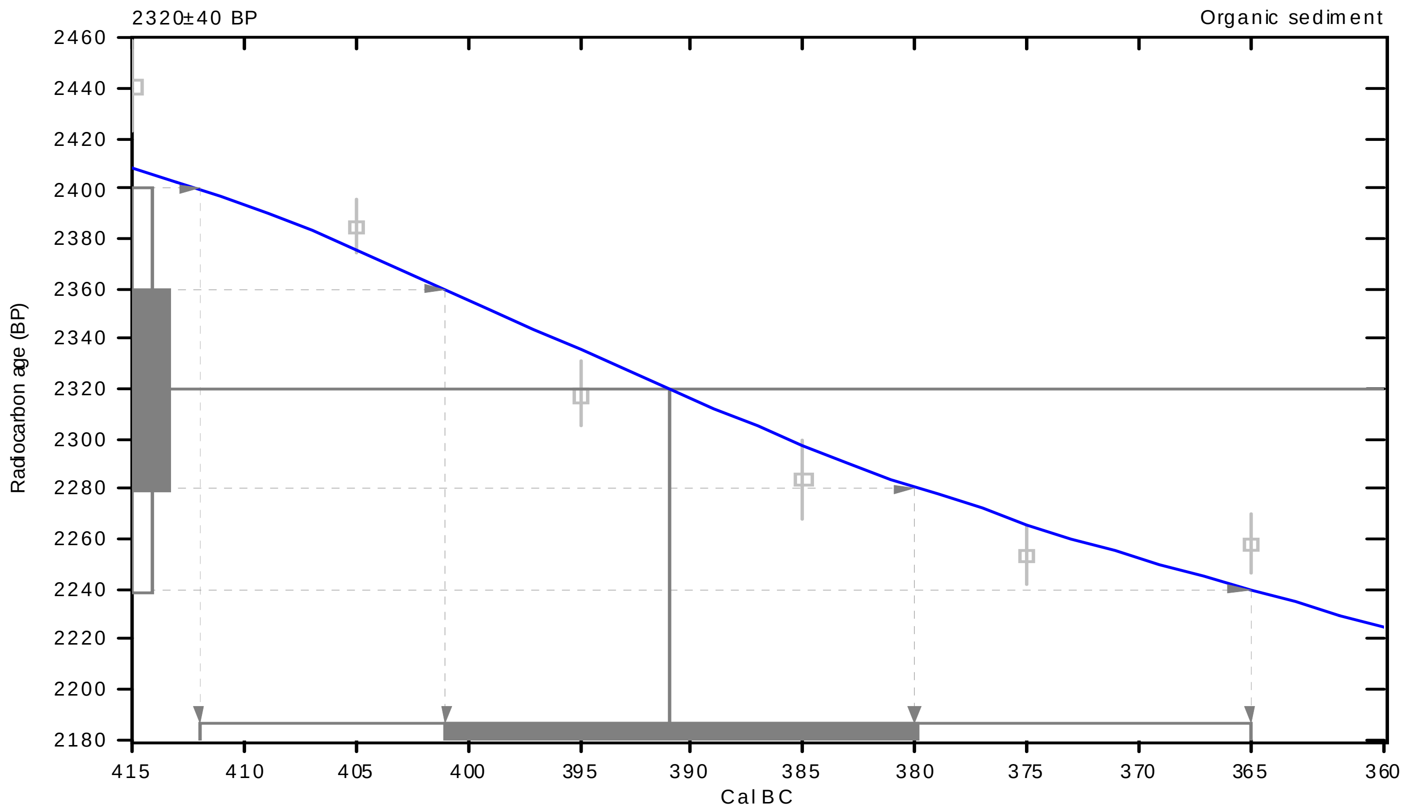
Conventional radiocarbon age: **2320±40 BP**

2 Sigma calibrated result: (95% probability) **Cal BC 410 to 360 (Cal BP 2360 to 2320)**

Intercept data

Intercept of radiocarbon age with calibration curve: Cal BC 390 (Cal BP 2340)

1 Sigma calibrated result: (68% probability) Cal BC 400 to 380 (Cal BP 2350 to 2330)



References:

Database used

INTCAL98

Calibration Database

Editorial Comment

Stuiver, M., van der Plicht, H., 1998, Radiocarbon 40(3), pxii-xiii

INTCAL98 Radiocarbon Age Calibration

Stuiver, M., et. al., 1998, Radiocarbon 40(3), p1041-1083

Mathematics

A Simplified Approach to Calibrating C14 Dates

Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2), p317-322

Beta Analytic Radiocarbon Dating Laboratory

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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-21.7:lab. mult=1)

Laboratory number: **Beta-222163**

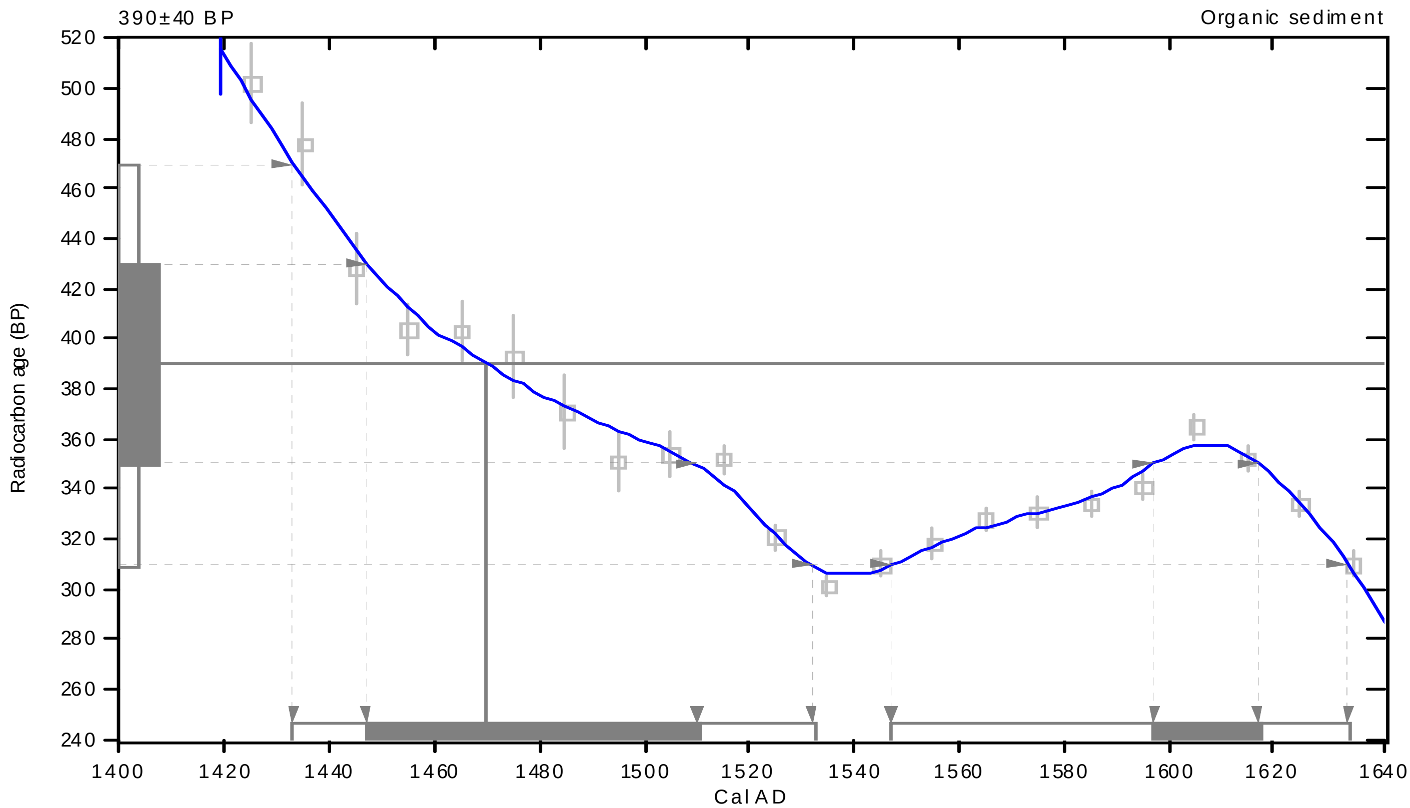
Conventional radiocarbon age: **390±40 BP**

2 Sigma calibrated results: **Cal AD 1430 to 1530 (Cal BP 520 to 420) and**
(95% probability) **Cal AD 1550 to 1630 (Cal BP 400 to 320)**

Intercept data

Intercept of radiocarbon age
with calibration curve: Cal AD 1470 (Cal BP 480)

1 Sigma calibrated results: Cal AD 1450 to 1510 (Cal BP 500 to 440) and
(68% probability) Cal AD 1600 to 1620 (Cal BP 350 to 330)



References:

Database used
INTCAL98
Calibration Database
Editorial Comment
Stuiver, M., van der Plicht, H., 1998, Radiocarbon 40(3), pxii-xiii
INTCAL98 Radiocarbon Age Calibration
Stuiver, M., et. al., 1998, Radiocarbon 40(3), p1041-1083
Mathematics
A Simplified Approach to Calibrating C14 Dates
Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2), p317-322

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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-27.2:lab. mult=1)

Laboratory number: **Beta-222164**

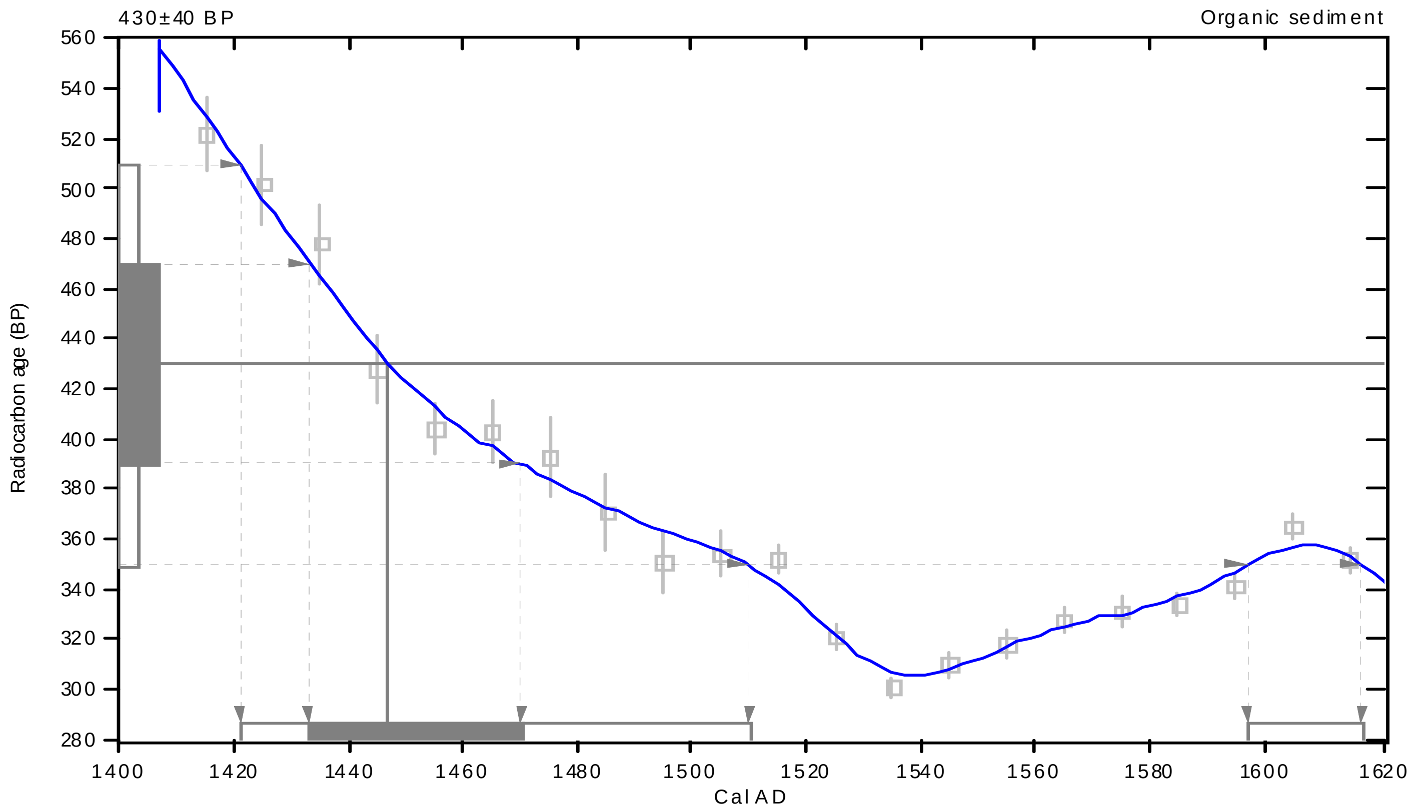
Conventional radiocarbon age: **430±40 BP**

2 Sigma calibrated results: **Cal AD 1420 to 1510 (Cal BP 530 to 440) and**
(95% probability) **Cal AD 1600 to 1620 (Cal BP 350 to 330)**

Intercept data

Intercept of radiocarbon age
with calibration curve: Cal AD 1450 (Cal BP 500)

1 Sigma calibrated result: Cal AD 1430 to 1470 (Cal BP 520 to 480)
(68% probability)



References:

Database used
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Editorial Comment
Stuiver, M., van der Plicht, H., 1998, Radiocarbon 40(3), pxii-xiii
INTCAL98 Radiocarbon Age Calibration
Stuiver, M., et. al., 1998, Radiocarbon 40(3), p1041-1083
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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-21.3:lab. mult=1)

Laboratory number: **Beta-222165**

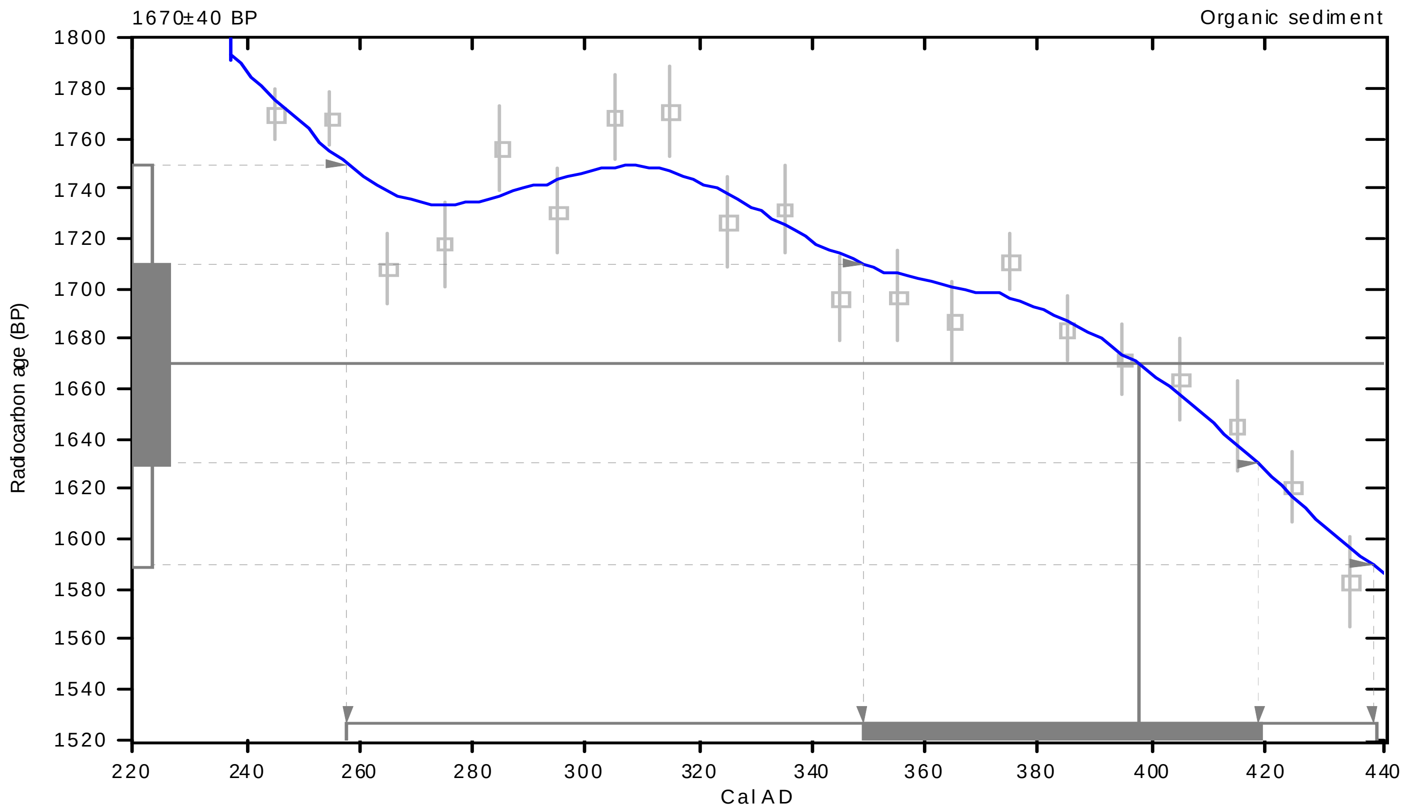
Conventional radiocarbon age: **1670±40 BP**

2 Sigma calibrated result: (95% probability) **Cal AD 260 to 440 (Cal BP 1690 to 1510)**

Intercept data

Intercept of radiocarbon age with calibration curve: Cal AD 400 (Cal BP 1550)

1 Sigma calibrated result: (68% probability) Cal AD 350 to 420 (Cal BP 1600 to 1530)



References:

Database used

INTCAL98

Calibration Database

Editorial Comment

Stuiver, M., van der Plicht, H., 1998, Radiocarbon 40(3), pxii-xiii

INTCAL98 Radiocarbon Age Calibration

Stuiver, M., et. al., 1998, Radiocarbon 40(3), p1041-1083

Mathematics

A Simplified Approach to Calibrating C14 Dates

Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2), p317-322

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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-20.7:lab. mult=1)

Laboratory number: **Beta-222166**

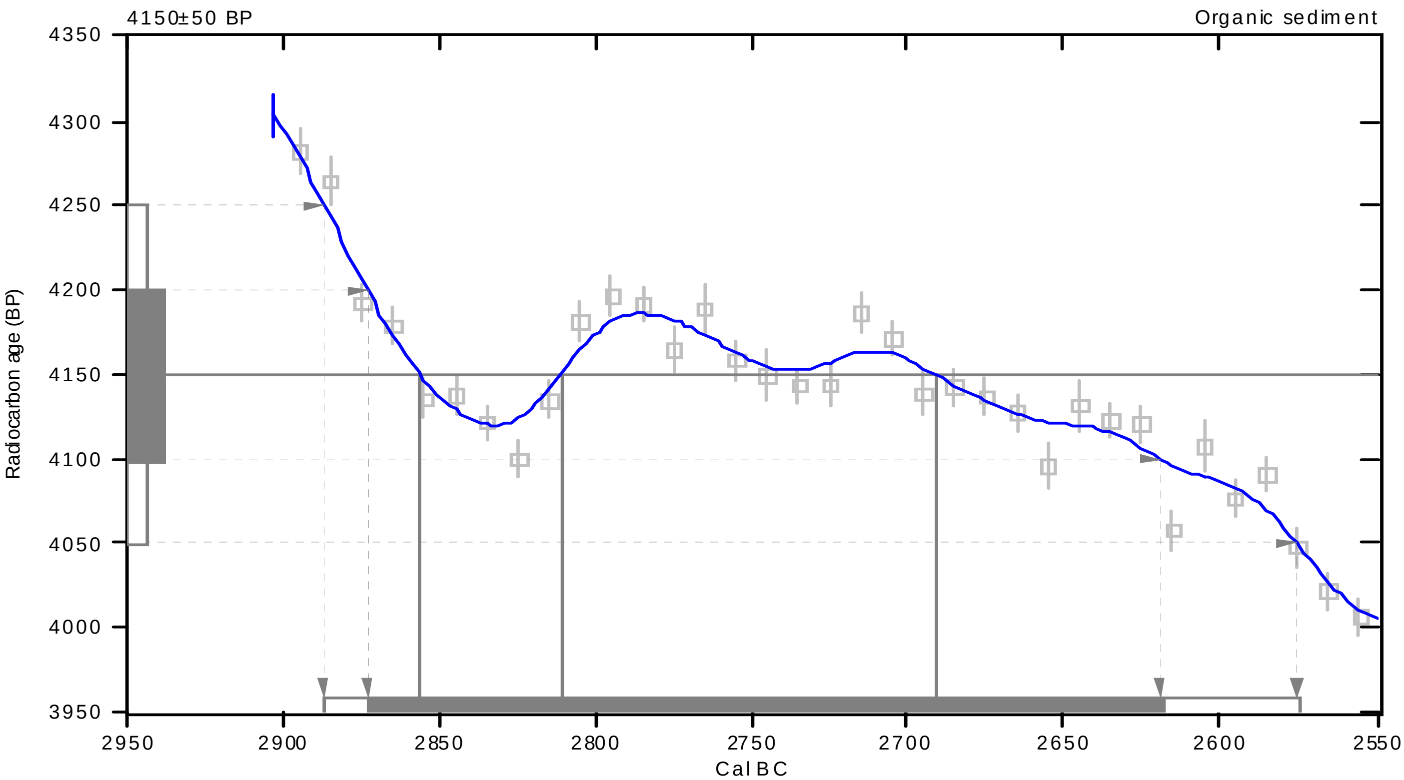
Conventional radiocarbon age: **4150±50 BP**

2 Sigma calibrated result: (95% probability) **Cal BC 2890 to 2580 (Cal BP 4840 to 4520)**

Intercept data

Intercepts of radiocarbon age with calibration curve: Cal BC 2860 (Cal BP 4810) and
Cal BC 2810 (Cal BP 4760) and
Cal BC 2690 (Cal BP 4640)

1 Sigma calibrated result: (68% probability) Cal BC 2870 to 2620 (Cal BP 4820 to 4570)



References:

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Calibration Database
Editorial Comment
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INTCAL98 Radiocarbon Age Calibration
Stuiver, M., et. al., 1998, Radiocarbon 40(3), p1041-1083
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Appendix E
Geomorphic Processes

APPENDIX E

GEOMORPHIC PROCESSES AFFECTING SITE GENESIS AND EPIGENESIS IN UPLAND AND TRIBUTARY VALLEY SETTINGS, WEBB COUNTY, TEXAS

S. Christopher Caran, Quarternary Analysis Laboratories, Austin, Texas

INTRODUCTION

In upland and tributary-valley settings of Webb County, Texas, geomorphic processes strongly influence archeological site context, development, preservation, modification, and destruction (Caran and Eling, 1992; Collins, 1992; Davis, 1992; Caran, 1994a, b; Caran, 1995; Caran and Turpin, 1995; Caran, 1998; Turpin and Caran, 1999; Quigg, 2000; Nordt, 2000). A variety of processes operate within the project area, although in general, all affect erosion, deposition, and/or pedogenesis, and thus the evolution of individual sites. Prior to the initial human presence on site, long-term erosion and deposition defined the conformation of the land and inherent properties of the substrate, modified by weathering/pedogenesis and non-human biological activity. The resulting natural landscape is the platform on which the site develops, primarily through anthropic activity, yet with continuing, albeit diminished effects of geomorphic processes. Those processes resume dominance after abandonment of the site and tend to corrupt and even destroy evidence of the human presence, but also may be responsible for site preservation. Consequently, the geoarcheological evolution of a site may be complex and difficult to interpret.

In terms of their direct effects on archeological sites, the principal processes operating in uplands of this region are: lateral erosion of stream banks and channel incision on flood plains of small, mostly intermittent tributaries; overbank deposition on flood plains; *in situ* weathering and pedogenesis on interfluves; sheet flow and erosion; slope-wash deposition; rill and gully erosion; tree throw; eolian deposition/deflation; and anthropic effects, often in combination. These processes are discussed below; and in order to gain some perspective on the degree to which they may affect cultural-resource potential, the rates at which they operate have been quantified where possible.

Before addressing these topics, however, we must first review the concept of site evolution and the nature of the site itself. This review is necessary because there have been multiple generations of overlapping site development within the project area and a long history of site modification by a host of human and non-human agents. The present net geoarcheological record is, therefore, a pastiche, reflecting the composite effects of anthropic activity and geomorphic processes, operating over an extended period. We must understand the role of these often competing, sometimes ramifying influences before we may properly assess the Prehistoric and Historic cultures of which we find material and other geoarcheological evidence. To this end, we will adopt a broad definition of "site," admitting even the most subtle residual properties denoting human presence. Our working understanding of "artifact" and "feature" must be equally accommodating.

CONCEPTUAL OVERVIEW OF SITE EVOULUTION

The evolution of a site involves both anthropic (deliberate and inadvertent) and natural processes. Site development or genesis requires human activity, without which there would be no site; but genesis is inexorably followed by progressive transformation or epigenesis of the evidence of that activity by geological, pedological, and biological agencies. Epigenetic processes often control site preservation, modification, or destruction, although the history of genetic activities is also influential and sometimes dominant. The genetic/epigenetic cycle of every site passes through some or all of the following discrete phases: pre-puissance (Pp); initial puissance (Pi); intensive puissance (Pt); declining puissance/abandonment (Pd/a); and post-puissance (Ps) (Figure E1; the term "puissance" is discussed in detail below, but in general refers to human presence).

Phases Pp, Pi, Pt, and Pd/a implement site genesis. Although the site did not exist prior to Pi (that is, the location was not an archeological site before the earliest *in situ* human activity), its context and intrinsic character were already established at time T_0, the moment of human arrival. Because these inherent properties of the site affected even its selection, the pre-puissance phase may be considered passively genetic when succeeded by overt site development (Pi, Pt, and Pd/a). Preservation and/or destruction of a site (Ps) are, by definition, epigenesis. The same geomorphic processes may have operated at the site during both the genetic and epigenetic phases, but were modulated or dominated by anthropogenic effects during site development. Some anthropic activities have a significant lingering influence on long-term site evolution long after abandonment. For example, site occupants may have deliberately buried their dead at the site in a way that enhanced preservation. The act of burial is part of the site's genetic history, even though its effects persist into epigenesis. In general, the longer and more intensive the genetic phases (especially Pt), the more likely they are to resist epigenetic change.

"Puissance" [pronounced 'pwis-^{a}n(t)s] is an English word meaning "to be able" (Woolf, 1975: *Webster's New Collegiate Dictionary*, p. 933; see also Anonymous, 1971: *The Compact Edition of the Oxford English Dictionary*, v. 2, p. 2353). Puissance is also a French word, generally translated as "power" (Terrell, 1996, p. 742). In the present context, puissance is defined as a human presence or activity that changes the environment in a way that leaves a tangible geoarcheological record. That record may be conspicuous or subtle. Change is effected at a specific location, over a finite, but variable time period, by any number of persons, and for any purpose or incidental to some other, purposeful activity. The type and degree of the effect is defined by geoarcheological evidence and may include unintended consequences. Puissance encompasses the traditional concept of site *occupation*, i.e., an extended, intensive domestic presence, but also includes ephemeral or casual site *visitation*, i.e., an isolated occurrence of transitory resource exploitation, such as opportunistic hunting and gathering by a mobile party of one or more persons. In a sense, puissance may refer to both the agent and the activity producing a change the environment. The evidence of that change is a "gisement," a geoarcheological deposit of cultural materials and any closely associated natural sediment at a site (Collins, 1995, p. 374; Collins and Brown, 2000, p. 8). "Gisement" is a French word, formally translated as either "a deposit" or "an archeological site," but perhaps combining elements of both (Terrell, 1996, p. 433).

The word puissance is here chosen because it has the appropriate meaning, but is not in common use in English and is, therefore, unencumbered by other connotations, which might confuse or conflict with this particular application. Puissance refers to a single occupational or exploitational occurrence at a given site, whether one day or a thousand years in duration. To create a site, some evidence of that occurrence must remain. Sites may, of course, be reoccupied--for example, by the same cultural group on a seasonal basis, or by an entirely different group after a long episode of abandonment. Each cycle of site genesis and epigenesis has a unique history. The evidence of events within any one of these cycles may be clear or superimposed and difficult to isolate from events before and after. Site chronology may become particularly obscure when there have been multiple occupations. Geoarcheological methods must be employed to isolate the overlapping site components and resolve uncertainty.

A determination of what constitutes a site may come into question. Conceptually, a site may be any place where one or more humans produced a geoarcheological record of their presence. That record consists of one or more artifacts in the broadest sense of that term, meaning "every form of archaeological find--from stone axes to clay pots, butchered animal bones, and manifestations of human behavior found in archaeological sites" (Fagan, 1989, p. 15). Is a locality containing a sin

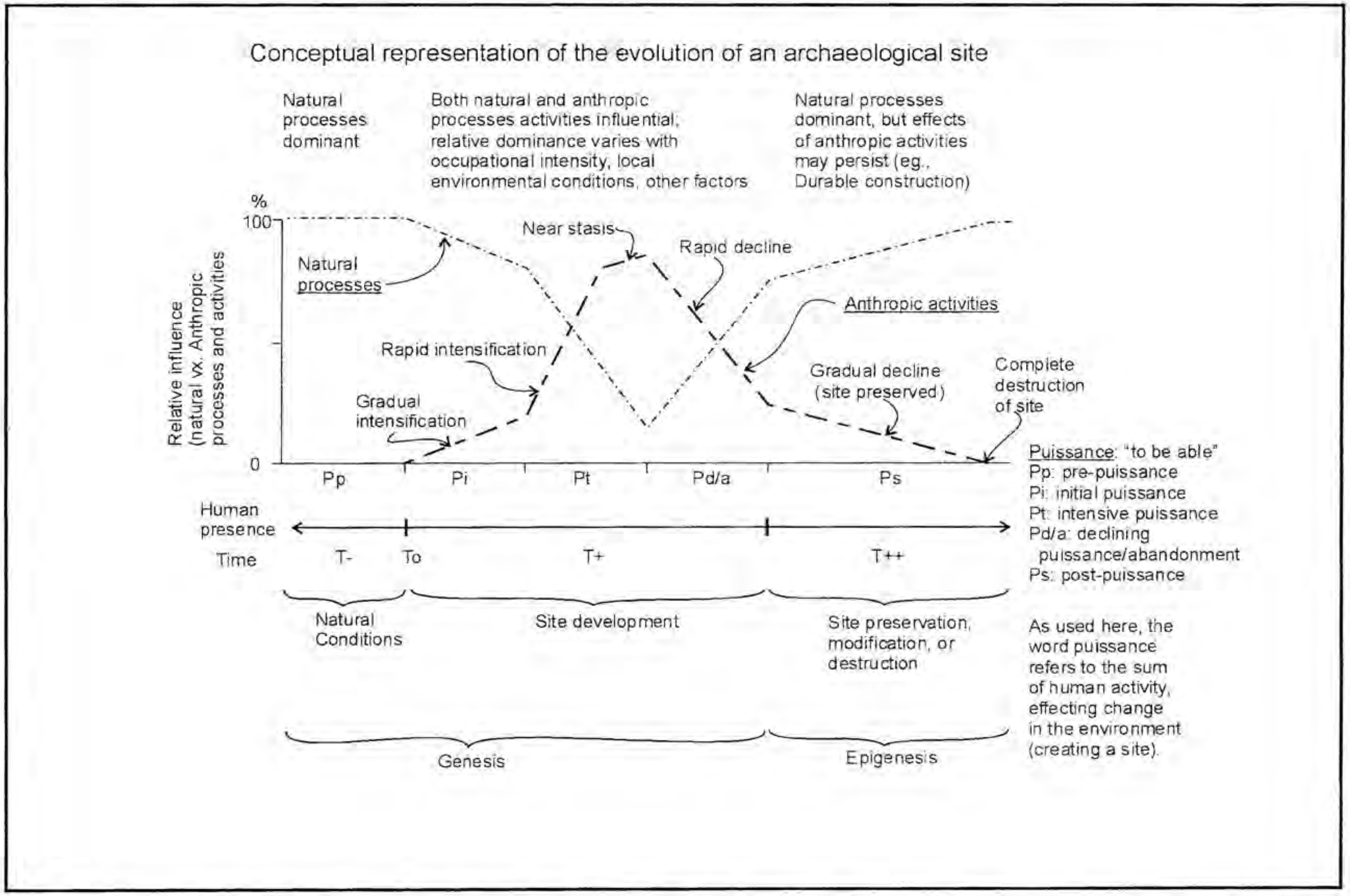

Figure E1. Conceptual representation of the evolution of an archaeological site.

gle artifact a site? If it were recovered from a plausible geoarcheological context, by this definition, the answer would be "yes." Most would agree that, even if the context were questionable, the nature of the artifact could influence site designation. For example, if that artifact were a pharaoh's sarcophagus, an Olmec stone head, or a period firearm with the name "David Crockett" engraved on the stock, there is little doubt that the place of discovery would be called a site. Whether lesser discoveries are sufficient for site designation is a procedural rather than a conceptual issue and is unimportant here.

Of perhaps greater interest is the question of whether non-traditional artifactual evidence of human presence is an adequate basis for defining a site. This depends on the ability of an investigator to detect and properly interpret geoarcheological evidence. A site might be recognized on the basis of geochemical evidence alone, such as an anomalously high concentration of phosphorous and nitrogen in the soil, inferred to mean that humans had prepared food and/or performed bodily functions in a particular place (Hester and others, 1997, p. 136). In effect, a site is any locality where one or more humans did something--anything--that left recognizable traces, i.e., produced artifacts in the broad sense (cf. Fagan, 1989, p. 15). As geoarcheological methodology is refined, the ability to recognize both artifacts and sites will improve and someday reveal even the most ephemeral evidence of human presence. Can a site be designated on the evidence of the bacterially consumed remains of a single human skin cell? One day, we may know.

GEOMORPHIC PROCESSES

As noted above, the most archeologically significant geomorphic processes operating in Webb County are: lateral erosion and chute-channel incision; overbank deposition; *in situ* weathering and pedogenesis; sheet flow and erosion; slope-wash deposition; rill and gully erosion; tree throw; eolian deposition/deflation; and anthropic effects. These processes will be discussed individually and quantified within the limits of available data. The present assessment focuses on effects in upland settings and the valleys of tributary streams with small watersheds. Most of the streams in these areas are intermittent, fed by runoff alone and flowing for only short periods following rainstorms.

LATERAL EROSION AND FLOOD-PLAIN INCISION ALONG STREAM CHANNELS

To understand the effects of runoff and stream flow, one must first be familiar with the nature of watersheds and stream networks. There is wide variation in the size of watersheds, ranging from a fraction of a square kilometer to a significant percentage of a continent. For example, the Rio Grande has a drainage area of approximately 460,000 km^2 or 6% of the area of the conterminous United States, whereas the watershed of the Mississippi River constitutes a third of the U.S. and part of Canada (Water Resources Division, 1949; Buckner and Shelby, 1991, p. 442). Southwestern Webb County lies within the watershed of the Rio Grande, whereas the northeastern part is in the Nueces River basin, and a small area in the southeast drains into coastal streams terminating in Baffin Bay (Geological Survey, 1985). A riverine watershed is subdivided into the separate, lesser watersheds of its principal tributaries, which in turn are divided into the watersheds of their tributaries and so forth. Theoretically, division could continue until each "watershed" would be expressed in terms of the micro-topography differentiating flow paths of individual raindrops as they reached the ground. Water always flows downhill, so micro-relief of only a few millimeters may in fact determine whether runoff reaches a particular site. High-resolution studies of runoff have shown that the force of impact of falling raindrops and the flow of extremely thin films of water are capable of eroding, transporting, and depositing sediment (Hairsine and Rose, 1991). These effects escalate as the flow from one micro-basin merges with that of another and continues to increase downslope until reaching the main or "trunk" stream in the area.

The process by which watersheds actually operate is complex, but for most purposes, a meaningful understanding of topographic relationships and site context can be obtained by examining conventional topographic maps, such as the 1:24,000-scale, 7.5-minute maps published by the United

States Geological Survey. Every terrestrial archeological site is located within a definable watershed, whether the site is in an upland setting or beside a stream channel. Runoff and/or stream flow reaches the site from an explicit part of the watershed directly upslope or upstream, which is known as the contributing area* (Strahler, 1963, p. 503-504). During major rainfall events, even tiny contributing areas may yield excessive runoff, producing flood stages in the stream reaches to which they drain. The frequency with which parts of southern, central, and north-central Texas experience intensive seasonal and episodic rainstorms is unusually high, such that these areas collectively encompass the most flood-prone region in the continental United States (Caran and Baker, 1986; Slade and Patton, 2003). Webb County lies just outside of this region, but could experience some of the same kinds of flood- and heavy runoff-producing events, and has received annual rainfall totals approaching 100% above average (Griffiths and Bryan, 1987, p. 505-506, 549). In addition, the Rio Grande has flooded catastrophically within Webb County as a result of rains upstream (Patterson, 1964, p. 481).

Runoff and stream flow can cause erosion in all or part of a watershed and along a stream channel. The sediment mobilized by erosion is then transported downslope or downstream and may be redeposited. Landscape denudation and sediment aggradation may affect the integrity of archeological sites, but fluvial erosion can be especially damaging. As discussed below, flood plains are among the most important geomorphic contexts for site development and preservation. During major flood events, these cultural resources may be at considerable risk, but even when a stream remains confined within its banks, flowing water can erode both the walls and floor of the channel and undercut the banks. Lateral (stream bank) erosion and incision of chute channels affect most flood plains (Figure E2). The channel wall and bank on the outside of a sharp bend are particularly vulnerable, in part because they bear the direct brunt of the flow before the stream is redirected.

A brief explanation of flow dynamics may help to explain this effect (for a more complete discussion, see Ritter and others, 1995, p. 213-218). In a stream, the flow *direction* is always downstream*, but the flow *rate* varies both vertically through the water column and horizontally across the channel. At any point along the channel transect, velocity diminishes precipitately downward, such that flow at the surface is much faster than at depth. It is, however, also true that flow throughout the water column is fastest above the deepest part of the stream channel, known as the thalweg, and slowest in the shallows along the channel margins or banks. The pattern of velocity resulting from these trends is especially complex in a meandering stream. In the straight reaches between bends, the channel is symmetrical in cross-section and deepest in the center. The two banks and channel margins erode at an even rate and erosion of the channel floor is proportional to velocity, just as in straight streams.

At a meander bend, however, the channel cross-section is asymmetrical. The outer bank, called the cutbank, is steep, whereas the inner bank, called the slip-off slope, is gently sloping. Depth is greatest near the cutback, where the flow velocities of both the surface water and bottom water are highest. This enhances erosion of the channel wall beneath the bank, often undercutting it and causing large sections to collapse. The resulting lateral erosion or bank recession may affect cultural resources on the flood plain or buried within its strata. In contrast to erosion of the cutbank, the slip-off slope is typically a locus of deposition, causing lateral accretion during periods of normal discharge. As the deposit increases in size, it projects into the channel and is called a point bar. Deflection of the stream around the point bar may further enhance erosion of the opposite cutbank. Bends of meandering streams are very unstable and the channel realigns itself continually.

* Excluded from the contributing area are any enclosed lakes, depressions, or other landforms where surface water is retained and from which flow is effectively interrupted.

* Exceptions to this rule include eddies, some macroturbulent features such as standing waves, some bottom currents, and other local anomalies.

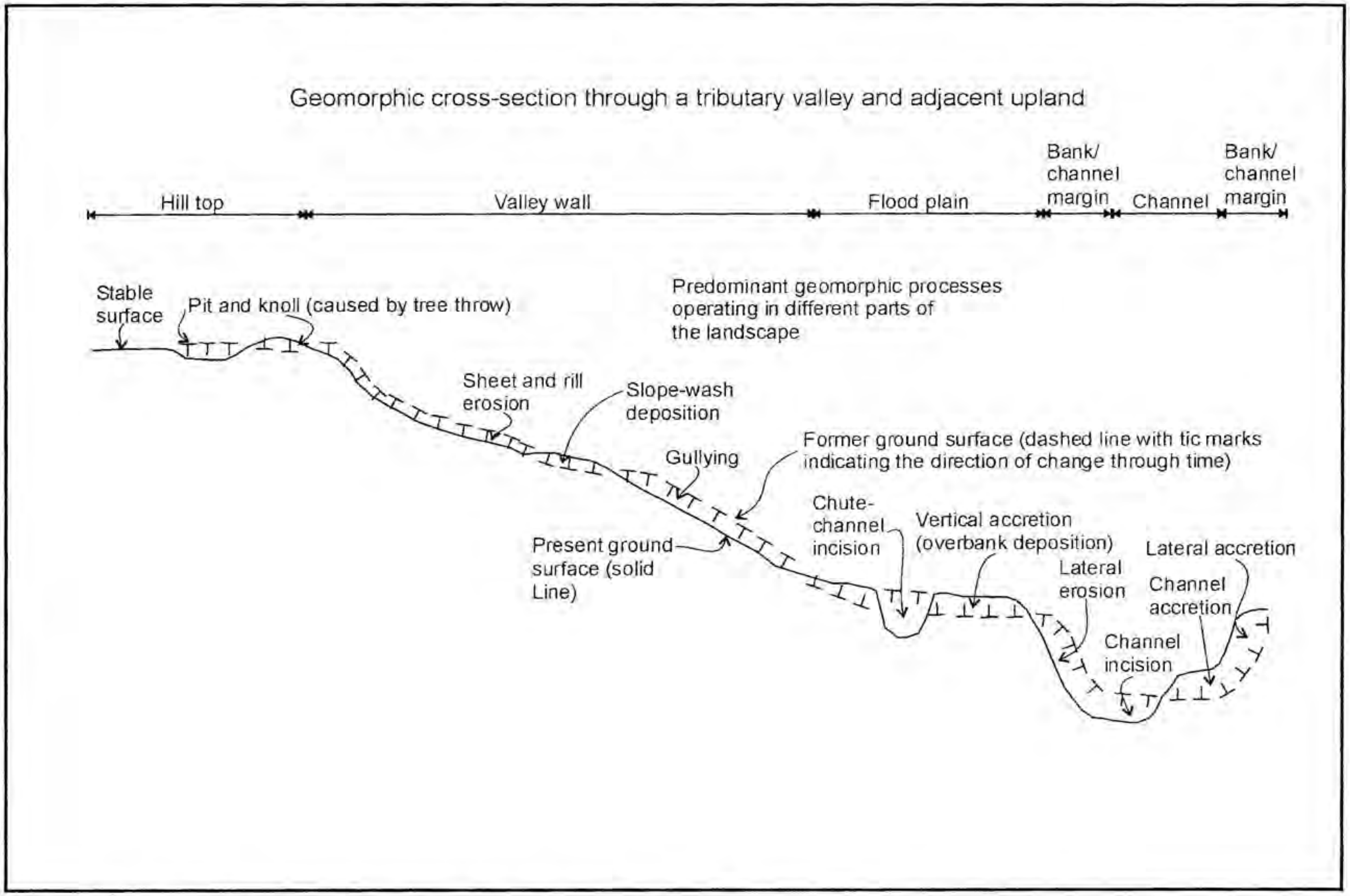

Figure E2. Geomorphic cross-section through a tributary valley and adjacent upland.

Stream behavior changes during a flood. In most streams, the effective definition of "flood stage" is met when the water level ("stream stage") rises above the "bankfull" stage: instead of flowing solely within its channel, the stream overtops its banks and spreads across the flood plain (Figure E3). Yet although moderate floods result in temporary inundation of all or part of the flood plain, there may be little erosion. In fact, sediment is often deposited (see "Overbank Deposition," below). Higher magnitude flood events can have more adverse effects, because the stream's competence (ability to transport large sedimentary particles) and capacity (ability to transport large quantities of sediment) increase markedly as flow accelerates. Normally, coarse sediment or bedload (also known as traction load) is stationary or rolls, slides, or bounces along the channel bottom. During extreme floods, however, high-velocity, highly turbulent flow can displace bedload onto the bank and adjacent (proximal) portions of the flood plain (see Blatt and others, 1980, p. 108-110). The channel may be deepened and realigned and the channel walls and banks scoured, not only at bends, but within straight reaches, as well, producing extensive lateral erosion.

Prolonged elevation of the water level also induces abnormally high hydraulic pressure on the channel walls and banks. For every 1-m rise in stream stage, the pressure increases 0.7 t/m^2, where t is a metric ton or 1000 kg (see Roberson and Crowe, 1975, p. 14, 46). This pressure is transmitted horizontally through the sediment underlying the flood plain, sometimes penetrating tens of meters. Under these conditions, the sediment may become water saturated, as air and soil gases that normally fill the interstices between sedimentary particles are entirely expelled and the pores fill with water. If the stream were to then recede or return to its channel abruptly, the greatly increased pore pressure within the sediment would exceed the confining pressure of the stream, resulting in bank failure and spontaneous collapse. This relatively rare form of lateral erosion is devastating, because it results in complete destruction of any archeological sites within the affected strata.

During extreme floods, when water levels are very high and flow is particularly rapid, a stream may incise a chute channel through its flood plain. In general, a chute is a relatively straight, narrow channel cut across the inside of a bend (Walker and Cant, 1984, p. 71-89). The flow through the chute is so powerful that it can transport coarse-grained sediment, even boulders. Any cultural features along this route will almost certainly be damaged or completely exscinded. Although flow velocity is very high, the small cross-sectional area of the chute channel cannot accommodate the entire flood volume. Evidently, only a fraction of the floodwater passes through the chute, while the rest follows the stream's original course or, at very high stages, flows across the open flood plain. The stream also may erode a new, permanent channel segment, often while avulsing an entire meander loop. The new segment is usually comparable in size to the original channel, but larger than the chute. Chutes are ephemeral: when the flood subsides, the chute is immediately abandoned as the stream reoccupies its original or modified channel exclusively. Normal lateral accretion fills the upstream end of the chute fairly quickly, whereas the downstream end may persist somewhat longer and the middle portion remains open for a time. The former chute channel forms an elongate pond or dry swale, trapping fine-grained, organic-rich sediment during subsequent, low-magnitude floods, or gradually filling with similar palustrine (pond) sediment. Because coarse-grained sediment may fill the lower part of the chute channel, the deposits accumulating in the chute are distinctly upward fining. These deposits are inset within the otherwise laterally continuous stratigraphic sequence underlying the flood plain (see Figure E3).

Erosion places archeological sites at risk. At the same time, it mobilizes sediment that may be transported to other sites and re-deposited. A quantitative review of erosion may provide some perspective. Tables E1 and E2 present published and calculated rates of denudation by running water (stream, gully, rill, and sheet erosion) at locations worldwide and throughout Texas. The rates vary widely, over three orders of magnitude from 0.0 to 1125 mm/yr, in part because of the range of environmental conditions encompassed by the regions treated, but also because the mechanisms of erosion differ. The highest rates also reflect anthropic influence. The rates at most localities in Texas are 1.0 mm/yr or less (see Table E2), but

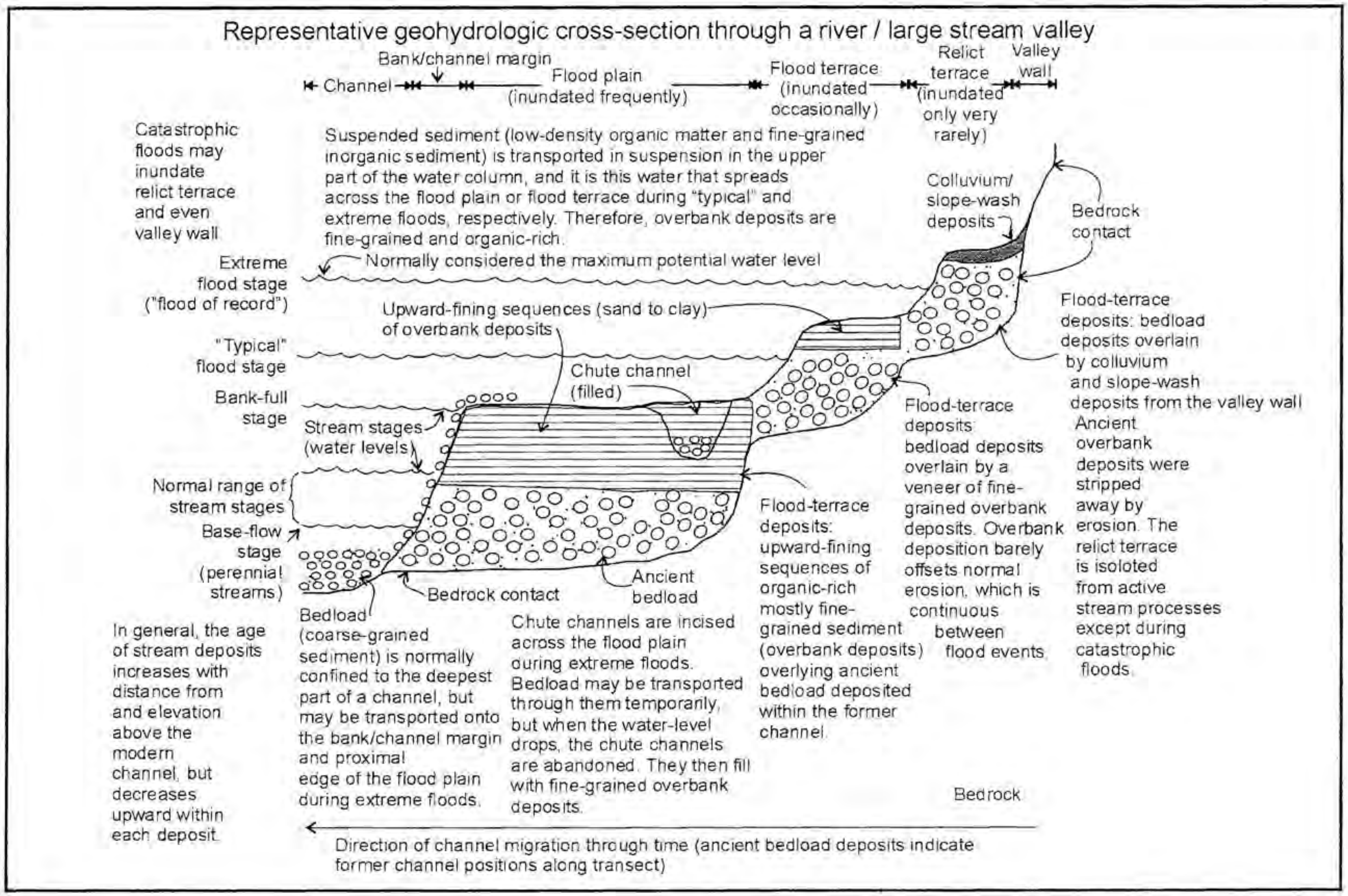

Figure E3. Representative geohydrologic cross-section through a river/large stream valley.

Table E1. Published and calculated rates of denudation by running water: global, regional, and local.

All rates are estimates of mean erosion per annum

A: Rate (mm/yr)	B: Reference	C: Area, discussion
Regional- to continental-scale denudation estimates based on the mean loads of dissolved and suspended sediment in major rivers. Bedload generally is not represented in these estimates, although Judson and Ritter (1964, p. 3398) assumed that bedload constitutes 10% of the total sediment load of most rivers and added a corresponding correction to their figure for suspended load.		
0.05334	Judson and Ritter (1964, Table 3)	Western Gulf of Mexico region: Texas (except Red River and Panhandle), southwestern Louisiana, southern and central New Mexico, and south-central Colorado.
0.01524	Dole and Stabler (1909)	Western Gulf of Mexico region (same as above).
0.03810-0.16510	Judson and Ritter (1964, Table 3)	Range of rates in regions of the contiguous United States other than the western Gulf of Mexico. Columbia River is lowest, Colorado River is highest.
0.01524-0.05842	Dole and Stabler (1909)	Range of rates in regions of the contiguous United States other than the western Gulf of Mexico. Columbia River is lowest, Colorado River is highest.
0.06096	Judson and Ritter (1964, Table 3)	Mean rate, contiguous United States.
0.016-0.43	Ahnert (1970, Table 1)	Range of rates, selected sites in United States, England, and continental Europe.

0.0535	Data from Howell and Murray (1986, Table 2, p. 448)	Worldwide mean rate, based on influx of 1.653 km^3/yr into ocean basins from 21% of total land area, ~1.47 x 10^8 km^2, indicating 7.871 km^3/yr of total denudation. Does not include 0.052 km^3/yr volcanic ash falling directly into the oceans.
0.04	Ritter (1986, Table 5.7)	North America and Central America
0.0103-0.141	Ritter (1986, Table 5.7)	Range of continent-wide rates, exclusive of Antarctica
0.025-0.15	Ritter (1986, Table 5.7)	Probable range of mean rates of denudation over large areas and/or long periods.
0.0035-0.5475	Pinet and Souriau (1988, Table 1)	Range of rates based on sediment loads of 45 largest rivers worldwide: Lena River, Siberia is lowest, Huangho River, China is highest.
0.0211-0.0836	Pinet and Souriau (1988, Table 1)	Range of rates based on sediment loads of 4 largest rivers in the United States: St Lawrence River is lowest, Colorado River is highest.

Local- to regional-scale denudation estimates based on various direct and indirect methods of calculation. Includes short-term and human-induced erosion, and, for some estimates, effects of bedload erosion and transport.

12.8	Schumm (1977)	Loess Hills, Iowa
4.3-14.0; mean 10.85	Megahan and others (1983, Table 1)	Range of rates and mean rate, erosion of weathered granite and/or granitic soils on steep slopes along an unsurfaced road in Idaho.

0.01-0.26	Saunders and Young (1983, Table 10)	Worldwide range of rates, primarily based on stream load and sedimentation monitoring; temperate climate, moderate relief, various substrates.
0.00-17.8	Saunders and Young (1983, Table 1)	Worldwide range of rates, based on various types of evidence; all conditions; highest rates reflect human impact.
0.005-1000.0	Saunders and Young (1983, p. 497)	Worldwide range of "typical" rates (minimum to maximum); all conditions.
12.9-82.5	Caran (1984, Table 7)	Range of rates, sheet and rill erosion of spoil at abandoned coal-mine sites in Texas; slopes moderate to steep, various substrates, vegetative cover suppressed by toxic chemical leachate.
35.7-1125.0	Caran (1984, Table 7)	Range of rates, gully and stream erosion of spoil at abandoned coal-mine sites in Texas; conditions same as above.
		Sheet, rill, gully, and stream erosion of spoil at abandoned coal-mine sites are related by the following regression: $Y = 0.0268X + 0.2444$, where Y is total erosion in meters and X is years before present to the period of mining (Caran, 1984, Fig. 31).
0.0116	Data from Meade and Parker (1985, Table 2, p. 50)	Columbia River basin prior to the 1980 eruption of Mount St. Helens volcano, Washington, based on estimated delivery of

		10,000,000 Mg/yr of suspended sediment to the river's mouth, averaged over the 6,700,000 km2 river-basin area (see Milliman and Meade, 1983, Table 2).
0.4893	Data from Meade and Parker (1985, Table 2, p. 50)	Columbia River basin immediately following the 1980 eruption of Mount St. Helens volcano, Washington; same basis as above.
0.0466	Data from Meade and Parker (1985, Table 2, p. 50)	Columbia River basin more than one year following the 1980 eruption of Mount St. Helens volcano, Washington; same basis as above.
2.0-28.0	Gustavson and Simpkins (1989)	Range of rates, maximum erosion at individual monitoring stations throughout the High Plains and Rolling Plains of Texas; subhumid to semiarid climate; variable slopes and substrates, includes areas where gypsic soils suppress vegetative cover.
1.3-6.1	Gustavson and Simpkins (1989)	Range of rates, mean erosion at individual monitoring stations throughout the High Plains and Rolling Plains of Texas; conditions same as above.
0.13-2.97	Gustavson and Simpkins (1989)	Range of rates at locations throughout the High Plains and Rolling Plains of Texas, based on various types of evidence; conditions same as above.

0.12-63.0	Gustavson and Simpkins (1989)	Range of published rates at locations in Arizona and New Mexico, based on various types of evidence; semiarid to arid climates, variable slopes and substrates.

Estimated denudation based on gross sediment yields at specific yield points (YPs) in Texas

0.035-1.000	Data from Greiner (1982, Table 1); see Table X1 of the present report for discussion	Range of rates, gross sheet and rill erosion; lowest in parts of Calhoun and Victoria counties (YP 239), highest in parts of Ellis, Hill, and Navarro counties (YP 115).
0.238	Data from Greiner (1982, Table 1)	Statewide mean rate, gross sheet and rill erosion.
0.000-0.869	Data from Greiner (1982, Table 1)	Range of rates, gross gully and stream erosion; lowest at a number of YPs (see Table X1, Footnote F, of the present report), highest in parts of Bexar and Wilson counties (YP 227).
0.101	Data from Greiner (1982, Table 1)	Statewide mean rate, gross gully and stream erosion.
0.035-1.350	Data from Greiner (1982, Table 1)	Range of rates, total erosion by running water; lowest in parts of Calhoun and Victoria counties (YP 239), highest in part of Montague County (YP 30).
0.339	Data from Greiner (1982, Table 1)	Statewide mean rate, total erosion by running water.

Footnotes

A: "Rate (mm/yr)" denotes a published or calculated rate of denudation by running water, including sheet and rill erosion and gully and stream erosion, but generally excluding channel incision and bedload transport. The unit of measure used here is mm/yr, although denudation is more commonly expressed in mm/1000 yr (mm/ka), also known as a Budnoff unit (B). Because most of the data in this compilation are based on short-term modern denudation, it is perhaps more appropriate to use mm/yr.

B: “Reference” is the citation for 1) a previously published rate, whether in the same or different units; or 2) data used to calculate an approximate rate of denudation.

C: “Area, discussion” refers to the area for which the rate was reported or calculated and the assumptions and/or methods employed in obtaining that rate.

Table E2. Summary of annual rates of erosion by moving water in Texas.

All rates are estimates of mean erosion per annum

A	B (Mg/hm^2)	C (m^3/hm^2)	D (mm/yr)	E (%)
Maximum rates of gross erosion at single yield points (YPs) in Texas				
Sheet and rill erosion (YP 115)	12.84	10.02	1.002	NA
Gully and stream erosion (YP 227)	11.14	8.69	0.869	NA
Total erosion (YP 30)	17.26	13.47	1.350	NA
Incremental sediment yield (YP 39)	6.77	5.28	0.528	NA
Minimum gross rates of erosion at single yield points (YPs) in Texas				
Sheet and rill erosion (YP 239)	0.45	0.35	0.035	NA
Gully and stream erosion (see footnote F)	0.00	0.00	0.000	NA
Total erosion (YP 239)	0.45	0.35	0.035	NA
Incremental sediment yield (YP 16)	0.045	0.035	0.0035	NA
Mean rates of gross erosion at all yield points (YPs) in Texas				
Sheet and rill erosion	3.05	2.38	0.238	70.1
Gully and stream erosion	1.30	1.01	0.101	29.9
Total erosion	4.35	3.39	0.339	100.0

Incremental sediment yield	1.35	1.05	0.105	NA

Footnotes

A: Data are from Greiner (1982) except where noted. These data represent estimated erosion and sediment yields based on sheet and rill erosion under 1979 conditions and gully and stream erosion under 1977 conditions. All reported values represent annual sediment losses. The data were originally expressed in English units of measurement, which are here converted to their metric equivalents. Conversion introduces minute numerical errors caused by rounding, and although these errors compound, the data should not be unduly compromised. Statewide rates are averaged over the total land area of Texas, 679,064 hm^2. Greiner (1982) referred to "streambank," rather than "stream" erosion, but the term is here simplified, while acknowledging that, in general, the effects of channel incision and bedload erosion are not included in these estimates. A yield point (YP) is a fixed point of reference along a stream. The location of each of the 300 yield points in this study is shown by Greiner (1982, Fig. 1). A yield point area (YPA) is the drainage area providing runoff, stream flow, and sediment to the yield point (YP) for which erosion was estimated. Each YPA represents a discrete portion of the stream's total watershed (drainage area). Erosion above each yield point was estimated using the Universal Soil-loss Equation, calibrated for observed sediment loads at selected monitoring stations across Texas. Sediment loss from "noncontributing areas" (areas of internal drainage that do not contribute to the stream directly) is not included in these estimates. Sheet and rill erosion is caused by sheet-flow runoff on unchanneled or micro-channeled slopes. Gully and stream erosion is caused by flow on gullied slopes and along intermittent and perennial streams. Sediment yields caused by sheet and rill erosion are tabulated separately from those caused by gully and stream erosion. In this table, "Total erosion" refers to the total erosion by running water, i.e., the sum of sheet and rill erosion and gully and stream erosion. "Incremental sediment yield" is the amount of sediment eroded from the yield-point area and delivered to the corresponding yield point, specifically excluding sediment eroded from other YPAs higher in the drainage basin and transported from a reach upstream.

B: "Mg/hm^2" denotes mean sediment loss in megagrams per square hectometer (i.e., mass per unit area). A square hectometer is sometimes referred to as a hectare. The data were originally reported in tons per acre (ton/ac), which were converted by multiplying ton/ac by 2.2417.

C: m^3/hm^2 denotes mean sediment loss in cubic meters per square hectometer (i.e., volume per unit area), based on a mean sediment density of 1.2814 Mg/m^3 (Leopold and others, 1964, App. A).

D. “mm/yr” denotes mean sediment loss in millimeters (i.e., thickness) per year, assuming uniform denudation throughout the yield-point area.

E: “%” denotes percentage of the statewide total erosion represented by each of the two components, sheet and rill erosion and gully and stream erosion. “NA” indicates the data category is not applicable.

F: Greiner (1982, Table 1) reported gross gully and stream erosion of 0.00 ton/ac at yield points 1, 8, 9, 16, 48, 66, 68, 104, 107, 108, 131, 139, 141, 147, 154, 157, 184, 185, 186, 187, 192, 193, 194, 196, 213, 224, 229, 231, 239, 240, 256, 258, 261, 262, 280, and 283.

these results are normalized over the areas of small drainage basins, whereas most of the rates quoted in Table E1 represent actual occurrences of local erosion. These data are provided for comparison with local rates discussed later. In addition, erosion rates serve as a rough guide to the amount of sediment that may accumulate farther downslope or downstream. By conceptualizing these rates, we gain insight into the role of geomorphic processes in site evolution. For example, a rate of 1.0 mm/yr corresponds to 1 m of erosion over 1000 yr. Few of the activities practiced by ancient Texans emplaced artifacts at depths as great as 1 m. Therefore, unless a locality has had a history of net sediment aggradation, virtually no Prehistoric sites could survive there.

OVERBANK DEPOSITION

Floods affect streams in many ways. They increase discharge (flow rate), turbulence, water depth, and the total volume of water moving through the channel. They also transport large quantities of sediment. The size and composition of the sedimentary particles, as well as the amount, are primarily affected by flow velocity and turbulence (Middleton and Southard, 1984, p. 6.1-6.55). As discussed previously, coarse-grained sediment is moved along the channel floor, and only extreme floods are capable of transporting that sediment onto the banks and flood plain or through chute channels. In contrast, fine-grained sediment is carried in suspension in the upper part of the water column, and it is this water that most often rises above the bank and pervades the flood plain, quickly dissipating the flood's energy (see Figure E3). Floods of low to moderate magnitude are far more common than are extreme or catastrophic events. For these reasons, vagrant floodwaters primarily transport and deposit suspended sediment, which consists of low-density organic matter and fine-grained particles of inorganic minerals (clay, silt, very fine to fine sand, and, rarely, medium sand). With a lateral decline in flow velocity, the stream's capacity to maintain even fine-grained sediment in suspension is diminished. The sediment is deposited successively, from coarsest to finest, producing upward fining sedimentary sequences like those in a chute channel, although the sediment at the base of the chute is much coarser. Deposition continues until the water has receded into the channel.

Simple inundation of the flood plain generally causes little damage to archeological sites. The sites are protected in two ways. Because flow velocity declines dramatically with distance from the banks, the slow flowing water cannot entrain (displace) heavy objects such as hearthstones and lithic artifacts. The water does transport large amounts of fine-grained, organic-rich sediment, which falls out of suspension as the flood wanes. The resulting overbank deposition is sufficient to bury archeological sites without disturbance, and because flood plains are submerged frequently, burial is both rapid and deep. This process increases site protection, but simultaneously dilutes the relative concentration of cultural materials per unit volume of sediment, thereby reducing the potential for site discovery. Along streams with high rates of vertical accretion, surficial surveys and shallow excavations have little chance of exposing Prehistoric sites (see Figure E2).

Overbank deposition can affect geomorphic terrains higher in the landscape. Streams rise to extreme flood stage infrequently, but by definition, flood terraces are inundated on occasion (see Figure E3). The resulting rate of overbank sedimentation is low, but sites on flood terraces can be buried gradually and thus partially protected. Inundation of landforms with still higher relief is so rare that sedimentation from floodwaters would not offset net denudation. In most environments, overbank deposition is the most important method of site preservation. Other burial mechanisms exist, but they are less effective in ensuring burial, particularly rapid burial soon after occupation. Most sites lying above the flood plain or flood terrace are poorly protected, and the likelihood of preserving a site at depths greater than a few tens of centimeters in upland contexts is small.

The rate of overbank deposition on a particular flood plain or flood terrace is most directly related to sediment yield upstream and to flood frequency (Tables E3, E4, and E5). Denudation under various conditions provides a gross indication of the amount of sediment displaced and, therefore, available for transport and deposition in analogous

Table E3. Rates of denudation by running water in Webb County, Texas.

All rates are estimates of mean erosion per annum				
A	B	C	D	E
Yield point area (YPA)	Mg/hm2	m3/hm2	mm/yr	%
Sheet and rill erosion				
246 (small part)	1.64	1.28	0.128	33.5
248 (part)	2.04	1.59	0.159	67.3
260 (small part)	1.77	1.38	0.138	65.8
261 (small part)	1.46	1.14	0.114	100.0
297 (part)	2.29	1.79	0.179	72.5
298 (part)	1.77	1.38	0.138	60.2
Gully and stream erosion				
246 (small part)	3.25	2.54	0.254	66.5
248 (part)	0.99	0.77	0.077	32.7
260 (small part)	0.92	0.72	0.072	34.2
261 (small part)	0.00	0.00	0.000	0.0
297 (part)	0.87	0.68	0.068	27.5
298 (part)	1.17	0.91	0.091	39.8
Total erosion by running water				
246 (small part)	4.89	3.82	0.382	100.0
248 (part)	3.03	2.36	0.236	100.0
260 (small part)	2.69	2.10	0.210	100.0
261 (small part)	1.46	1.14	0.114	100.0
297 (part)	3.16	2.47	0.247	100.0
298 (part)	2.94	2.29	0.229	100.0

Incremental sediment yield

246 (small part)	2.11	1.65	0.165	NA
248 (part)	0.83	0.65	0.065	NA
260 (small part)	0.61	0.48	0.048	NA
261 (small part)	0.13	0.10	0.010	NA
297 (part)	0.72	0.56	0.056	NA
298 (part)	0.85	0.66	0.066	NA

Footnotes

A: Data are from Greiner (1982, Table 1). See additional discussion in Table X1 of the present report. The data were originally expressed in English units of measurement, which are here converted to their metric equivalents. Conversion introduces minute numerical errors caused by rounding, and although these errors compound, the data should not be unduly compromised. All reported values represent annual sediment losses. A yield point area (YPA) is the drainage area providing runoff, stream flow, and sediment to the yield point (YP) for which erosion was estimated. Erosion above each yield point was estimated using the Universal Soil-loss Equation, calibrated for observed sediment loads at selected monitoring stations across Texas. Sediment loss from "noncontributing areas" (areas of internal drainage that do not contribute to the stream directly) is not included in these estimates. Sediment yields caused by sheet and rill erosion are tabulated separately from those caused by gully and stream erosion. "Total erosion by running water" is the sum of sheet and rill erosion and gully and stream erosion. "Incremental sediment yield" is the amount of sediment eroded within the yield-point area and delivered to the corresponding yield point, specifically excluding sediment eroded from other YPAs higher in the drainage basin and transported from a reach upstream. The location of each of the 300 YPs and YPAs in this study is shown by Greiner (1982, Fig. 1).

B: "Mg/hm^2" denotes mean sediment loss in megagrams per square hectometer (i.e., mass per unit area). A square hectometer is sometimes referred to as a hectare. The erosional data were originally reported in tons per acre (ton/ac), which were converted by multiplying ton/ac by 2.2417.

C: m^3/hm^2 denotes mean sediment loss in cubic meters per square hectometer (i.e., volume per unit area), based on a mean sediment density of 1.2814 Mg/m^3 (Leopold and others, 1964, App. A).

D. “mm/yr” denotes mean sediment loss in millimeters (i.e., thickness) per year, assuming uniform denudation throughout the yield-point area.

E: “%” denotes percentage of the total erosion represented by each of the two components, sheet and rill erosion and gully and stream erosion. “NA” indicates the data category is not applicable.

Table E4. Flood data for small streams comparable to those in the Rio Grande watershed of Webb County, Texas.

There are no long-term flood records for small streams in the Rio Grande watershed of Webb County. For this reason, data from streams similar to those of the current project area are also listed, although the contributing drainage areas of most of the other streams are much larger than those of the local streams. For reference, data for the Rio Grande at Laredo, Webb County, are also included. All of the data were originally report in English units of measure, but were converted to their metric equivalents here.

Gage location (drainage basin)	Drainage area (km^2)	Stage (m), (year)	Source
Chiltipin Creek at Sinton, San Patricio Co. (Aransas River)	331.5	9.4 (1930) 9.8 (1967) 9.5 (1971) 9.0 (1985)	Buckner and Shelby (1991, p. 373)
San Casimiro Creek near Freer, Webb Co. (Nueces River)	1214.7	7.9 (1954) 8.2 (1971)	Buckner and Shelby (1991, p. 381)
Hondo Creek near Tarpley, Medina Co. (Nueces River)	247.6	7.9 (1932) 8.6 (1958)	Buckner and Shelby (1991, p. 394)
San Miguel Creek near Tilden, McMullen Co. (Nueces River)	2028.0	9.9 (1942) 8.3 (1980)	Buckner and Shelby (1991, p. 404)
Oso Creek at Corpus Christi, Nueces Co. (Oso Creek)	233.9	7.5 (1968) 9.0 (1980)	Buckner and Shelby (1991, p. 415)
San Felipe Creek near Del Rio, Val Verde Co. (Rio Grande)	119.1	7.1 (1935) 6.2 (1948) 6.7 (1952) 8.2 (1954)	Patterson (1965, p. 477)
Pinto Creek near Del Rio, Val Verde Co. (Rio Grande)	644.9	7.1 (1935) 6.2 (1948) 6.7 (1952) 8.2 (1954)	Patterson (1965, p. 477)

Rio Grande at Laredo, Webb Co. (Rio Grande)	352,176.2	19.1 (1865) 15.5 (1922 15.0 (1932) 18.7 (1954)	Patterson (1965, p. 481)

Table E5. Published and calculated rates of aggradation by running water: local and regional.

All rates are estimates of mean erosion per annum

A: Rate (mm/yr)	B: Reference	C: Area, discussion
The following local- to regional-scale aggradation estimates are based on direct monitoring and/or net thickness measurements of dated sedimentary sequences. The latter are uncorrected for the effects--probably minor--of compaction and/or pedogenesis, but hiatal disruptions were avoided where evident.		
0.97	Data from Nordt (2000, p. 24-27)	Calculated rate: Webb County, Texas; late Holocene; overbank deposition on flood plain of Santa Isabel Creek; subtropical climate; gentle slope; silty sandy soil; brushland.
0.15-0.30	Data from Nordt (2000, p. 24-27)	Range of calculated rates: Webb County, Texas; late Holocene; overbank deposition on T1 terrace of Santa Isabel and Tejones creeks; subtropical climate; gentle slopes; silty sandy soils; brushlands.
0.55	Data from Gustavson and Collins (1998, p. 49-55)	Calculated rate: Val Verde County, Texas; late Holocene; overbank deposition on fill terrace of Sycamore Creek; subtropical climate; silty sandy soil; gentle slope; brushland.
0.37-1.16	Data from Caran (1998, p. 56-67)	Range of calculated rates: Webb County, Texas; late Holocene; overbank deposition on T2 flood terrace of Rio Grande; subtropical climate; silty sandy soils; gentle slopes; brushlands.

0.28-1.00	Data from Caran (1993, p. A-6)	Range of calculated rates: Maverick County, Texas; late Holocene; overbank deposition on flood terraces of Rio Grande; subtropical climate; silty sandy soils; gentle slopes; brushlands.
0.20-10.30	Ferring (1986, Table 1)	Range of reported rates, calculated over various periods of record: numerous sites in eastern and central United States; all or part of the Holocene Epoch; various conditions.
11.00-29.00	Gustavson and Simpkins (1989)	Range of rates of maximum aggradation at individual monitoring stations: High Plains and Rolling Plains of Texas; modern; slope-wash and overbank deposition; semiarid to subhumid climates; variable slopes and substrates; some locations may have received minor contributions of eolian sediment.

Footnotes

A: “Rate (mm/yr)” denotes a published or calculated rate of aggradation by running water (slope-wash and overbank deposition).

B: “Reference” is the citation for 1) a previously published rate, whether in the same or different units of measure; or 2) data used to calculate an approximate rate of aggradation.

C: “Area, discussion” refers to the area for which the rate was reported or calculated, the local conditions in the area, and factors affecting the applicability of the rate.

settings (see Tables E1 and E2). Fortunately, there is a source of data directly pertinent to the Webb County project area (see Table E3). Local erosion was both monitored and estimated based on Universal Soil Loss modeling as part of a statewide study by Greiner (1982). Greiner divided the state into 300 watershed segments called Yield-Point Areas (YPAs). At the downstream end of each YPA is the designated Yield Point (YP) for which the erosion was calculated. Erosion throughout the YPA was assumed to be uniform, so the reported rate is the normalized mean over that area. Sheet and rill erosion were differentiated from erosion by gullies and streams, and the total erosion is from all four of these causes. The data were reported in terms of Incremental Sediment Yield, which was the actual loss in that discrete YPA, excluding effects upstream. Portions of six YPAs converged in Webb County (Figure E4). The data actually pertain to the entire area encompassed by these six, not merely to Webb County. For example, only a small portion of YPA 246 extends into northern Webb County, but the rates of erosion per unit area in that portion are the same as those in the rest of the YPA: slopes in the uplands are being denuded at a rate of 0.128 mm/yr, whereas the stream banks erode 0.254 mm/yr, and total gross erosion is 0.382 mm/yr. The amount of sediment actually reaching the yield point (i.e., the incremental sediment yield) is equivalent to 0.165 mm/yr. Among the six YPAs, erosion rates vary as follows: sheet and rill, 0.114 to 0.179 mm/yr; gully and stream, 0.000 to 0.254 mm/yr; gross total, 0.114 to 0.382 mm/yr; and incremental sediment yield, 0.010 to 0.165 mm/yr. These figures are comparable to observed rates of sediment aggradation, which indicates that erosion in one part of a watershed increases the supply of sediment that may be deposited downslope or downstream, and in like quantities (see Table E5). Many factors influence sedimentation, but the reported range of values in Table E5 is instructive. Notably, most of these rates are local and represent overbank deposition on stream and river terraces.

In addition to the available sediment supply, overbank deposition is controlled by flood stage and flood frequency. Records from a network of stream gauges within the county would provide a clear indication of where flood-borne sediment was deposited and how often deposition has occurred. Data for the Rio Grande are available from as early as 1865, but the only long-term record for a small stream in Webb County is from San Casimiro Creek in the Nueces River watershed (Buckner and Shelby, 1991, p. 381). The best alternative to local monitoring data is information from analogous contexts. Table E4 is a compilation of stream stages during historical floods at a number of nearby locations with comparable terrain and climatic conditions. By matching the contributing portion of the drainage area of a stream in Webb County with that of a stream for which there are historical flood records, one may estimate the potential local flood stage and the approximate recurrence of floods of similar magnitude. For example, let us assume that a hypothetical stream in Webb County has a contributing drainage area comparable to that of San Felipe Creek near Del Rio. By analogy, the stream in Webb County may have reached a flood stage of ≥6 m approximately as often as did San Felipe Creek: four times between 1935 and 1954, or about once every five years. Moreover, the highest stage of record on San Felipe Creek is 8.2 m in 1954. The period of monitoring at that location is too short to be certain, but it is probable that a terrace more than 8.2 m above the channel of the hypothetical stream is relict. Any cultural materials on that geomorphic surface would probably be unprotected by sedimentary cover.

This method of assessing cultural-resource potential and the probable age of deposits associated with particular landforms is not without uncertainty. Even if the recorded flood history were far longer than that of San Felipe Creek, it is possible that hydrologic conditions in ancient times were far different. San Felipe Creek may have undergone several meters of downcutting over the past 8000 years, and the now relict terrace may have been inundated often prior to that phase of channel erosion. Analogies based on modern records become less reliable as the age of a landform and its deposits increases. In practice, the present investigator has found that flood histories are useful analogs of geomorphic evolution since the middle Holocene Epoch, approximately the past 5000 years (see Orndorff, 2007).

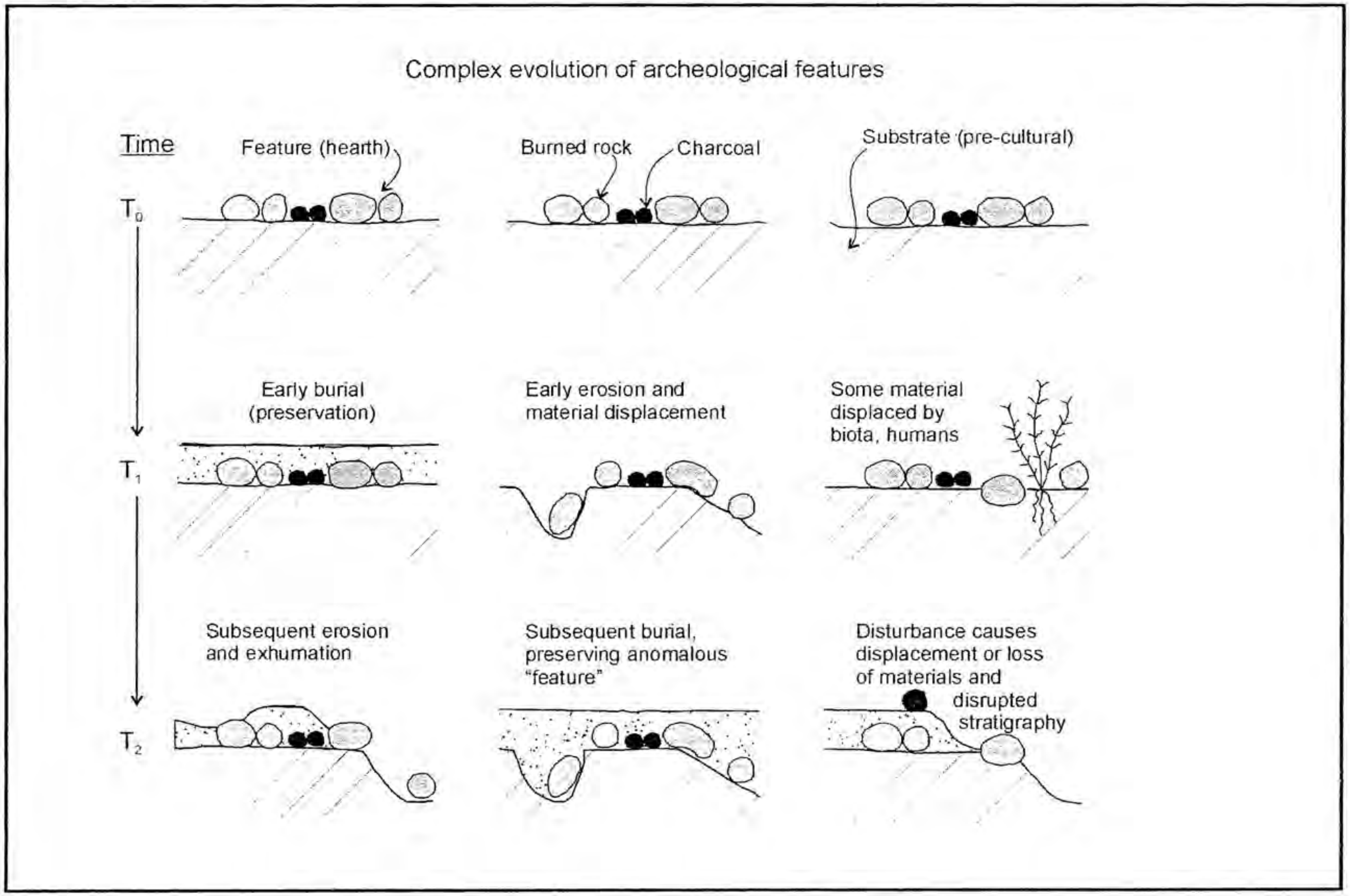

Figure E4. Complex evolution of archaeological features.

IN SITU WEATHERING AND PEDOGENESIS

Unlike episodic events like flooding, many geomorphic processes operate on a nearly continuous basis. Exposed bedrock and sediment undergo progressive changes as their rock and mineral components are subjected to oxidation, reduction, hydration, desiccation, solar illumination, thermal stress, recrystallization, biological corrosion, mechanical disaggregation, and other physical and chemical effects (Birkeland, 1984, p. 61-90; Ritter and others, 1995, p. 50-63). Organic materials are particularly susceptible to degradation unless they are isolated from atmospheric oxygen, mechanical abrasion, and fluctuations of moisture and temperature (see Holloway, 1989). Weathering processes operate *in situ*, affecting geological materials in different ways and at different rates. Some components dissolve entirely, others become more concentrated, and some form new minerals or mineraloids. The resulting veneer of altered rock and mineral particles forms a residuum of generally loose earth, also known as saprolite. In many areas, erosion has stripped away almost all evidence of weathering, but saprolites are preserved in some contexts.

Weathering selectively removes the most soluble constituents, such as limestone, feldspar, and mica, and thereby effectively concentrates those particles that are more durable, particularly quartz, quartzite, and chert fragments. The residuum also may become enriched in amorphous aluminum and oxides of iron and manganese, which are relatively immobile, causing reddening or rubification. Extremely fine-grained sediment, ions dissolved in rainwater or shallow ground water, and various exogenous substances such as wind-borne pollen may be added from atmospheric sources. [Material transported from locations upslope are discussed in later sections of this report.] Concurrently, the growth of plants increases the amount of organic matter and enhances water infiltration and the internal redistribution of clay, carbonaceous substances, soluble minerals, reduced iron, and other soil products. These processes are pedogenic because they produce a mantle of residual soil with properties contrasting with those of the subjacent, unmodified parent material. Formation of a thick, reddened, residual soil with well-developed horizons may require millennia. Once established, however, this soil may persist with minimal modification.

The types of soils developed on a landform are often an excellent guide to weathering, depositional and pedogenic history, and, thus, cultural-resource potential (Birkeland, 1984; Soil Survey Staff, 1999). For example, Entisols are soils usually developed in very recently deposited, unmodified sediment, such as modern fluvial deposits (alluvium). Such soils are unlikely to contain either buried or surficial Prehistoric features because 1) the soil's parent materials are too young and 2) the environments of deposition where this soil type is found are generally unstable and not conducive to occupation and site genesis. Yet these conditions might make the location a candidate for discovery of an Historic site, such as the remains of a wharf. Other soils, including Alfisols, have properties showing they have undergone extensive and prolonged pedogenesis, generally without significant ongoing sedimentation. These are often characteristics of a stable landform with exposed or shallow-buried bedrock subjected to *in situ* weathering and soil development. In most areas, there would be very low probability of the presence of a buried site; but in fact, some Paleoindian sites have been found deeply buried in precisely this kind of soil. Soil types are useful indicators, but cannot replace knowledge of local geomorphic conditions.

Organisms and organic matter often play a significant role in weathering and soil development (Brady, 1974, p. 111-163; Birkeland, 1984, p. 260-274). Organic matter adds essential nutrients, improves soil tilth, enhances moisture retention, and serves as an adsorptive medium for translocation of iron and other metals through the soil horizons. *In situ* oxidation of organic carbon produces carbon dioxide, a geochemically important, water-soluble soil gas. Biofilms--colonies of microorganisms forming biochemically active coatings on ground surfaces and sedimentary particles--dissolve some soil components, but also precipitate minerals (see Riding and Awramik, 2000). Soil algae, fungi, lichens, and other taxa encrust rocks and soils, gradually decomposing many of the solid constituents, but adding small amounts of organic carbon essential in soil building and plant succession. Vascular plants modify soils both chemically, through reactions with humic acids and the addition of organic matter, and mechanically, through bioturbation. The term bioturbation refers to a range of processes whereby plants and animals (including humans) disturb the substrate through root growth, burrowing, compaction, ingestion, devegetation, direct removal, plowing, and many other activities (see Waters, 1992, p. 104-105). Effects are felt at the ground surface and throughout the pedologic profile to depths of tens of meters. Impact on stratigraphic integrity and the soil's internal structure is immediate and may persist for extended periods. Mechanical bioturbation affects all soils, but is especially significant in areas where the rate of deposition is slow, allowing complete mixing of newly accreted sediment prior to the next depositional event. Archeological sites may be completely destroyed by organisms such as fossorial insects and mammals, and migratory herds of ungulates that may crush or disperse surficial features. Tree throw, a special form of plant bioturbation, is discussed later in this report.

SHEET FLOW, SLOPE-WASH DEPOSITION, AND RILL AND GULLY EROSION

Sheet flow, slope-wash deposition, and rill and gully erosion affect most upland landscapes, particularly where vegetation is limited (Strahler 1964, p. 470-474; Ritter and others, 1995, p. 177-180). Loss of ground cover, alteration of natural ground contours, and direct disturbance of soil cohesion can increase the erosive effects of runoff in all its forms. Sheet, rill, and gully erosion mobilize sediment, which is then transported downslope (see Figure E2). Despite the diffuse nature of these processes, they operate over vast areas, and, collectively, distribute large quantities of sediment.

Sheet flow is most evident on relatively smooth, continuous slopes with moderate to steep gradients, where precipitation runs off as a film of water unconfined in a channel or micro-channel, and where infiltration of moisture is restricted (see Figure E2). The flowing water may erode and transport fine-grained, low-density particles of organic matter and inorganic sediment, redepositing them downslope as slope wash. Sheet-flow erosion and deposition are influenced by many factors, including flora, the nature of the substrate, and surface roughness. Plants tend to hold soil in place, protect it from direct impact of raindrops, and disrupt the continuity of bare slopes over which runoff flows most easily. Substrates, by their nature, may be easily eroded or erosion resistant, and vary greatly in terms of their permeability. A weakly cohesive sandstone may be easily eroded, but too permeable to allow water to flow over its surface without significant infiltration. A hard limestone may be too durable to yield sediment, but can enhance sheet flow by impeding infiltration, allowing runoff to continue downslope. Slope roughness and micro-topographic irregularities are capable of diverting and disrupting flow or concentrating and directing it along preferred pathways.

These preferred flow paths might become incised, forming shallow micro-channels or rills, usually perpendicular to the local topographic contours. There is a continuous gradation between sheet and rill flow and the same factors affect both. Rills are found on loose sediment, soil, and bedrock. Where limestone or other soluble rock types lie buried at shallow depth, rills can form underground as infiltrating water moves along a sloping bedrock-soil interface, etching the rock chemically over a long period. If this bedrock surface is later exhumed, the rills may appear to have formed in the more conspicuous manner, but are actually inherited from their original subterranean context.

With continued erosion, rills may develop into gullies, which are ephemeral channels wider and deeper than rills, but poorly integrated with the stream network. Gullies also form where runoff collects in shallow depressions or swales, then overflows causing rapid incision. It is not uncommon to find gullies on the lower slope of a valley wall just above a flat flood plain or stream terrace. The abrupt change in slope gradient may appear to have terminated gullying, but in fact, the surface water flowing through the gullies infiltrates the porous stream deposits, rather than flowing over the low-relief ground surface. In areas with porous soils on moderate slopes, discharge of ground water may create gullies, as well, and gullying can be closely linked to a process known as piping. Piping is a form of erosion caused by the movement of ground water through a weakly consolidated porous medium. The underground flow path is often so well defined that it acts like a pipe and may create an open conduit. If this conduit breaks through to the ground surface it becomes a gully. Gullies may eventually link with streams and become well-defined tributaries, but they also may be isolated from the slope that supplied them with water and become inactive, gradually filling with sediment.

Both erosional and depositional slope processes affect archeological features and cultural materials. Figure E4 illustrates the contrasting effects of early and continual burial versus continual erosion and *in situ* degradation. Sediment accretion by overbank and slope-wash deposition may cause little or no disturbance. Through time, a buried feature is comparatively insulated from disturbances such as erosion, and as the thickness of the overlying sediment increases, there are fewer opportunities for direct disturbance from bioturbation. Conversely, pedoturbation--a process similar to bioturbation but primarily abiotic in nature--increases with time and compactional load, as does *in situ* degradation of perishable components, particularly organic matter. There are many causes of pedoturbation, of which the most common are vertic (shrink-swell) volume changes within horizons, causing stones and other dense particles to be displaced or reoriented.

The effects of erosion are perhaps more conspicuous. Gullying may incise the ground surface and transport particles as large as small boulders, then rebury them creating stratigraphic relationships unrelated to the human activities. Feature components also move laterally as a result of sheet erosion, which removes fine particles, thereby undermining and thus destabilizing larger objects, and soil creep, an internal process of gravity sliding affecting some soils, especially those with a high clay content when they are wet. Displaced hearthstones may even be regrouped downslope, creating an "apparent" feature. Even more complex disturbances are seen. Burial may be followed by a later episode of erosion and exhumation of the feature. Likewise, an eroded feature may be subsequently buried, preserving its disrupted character and anomalous appearance. Disturbance or even loss of feature components may be caused by bioturbation, direct human influence, or erosional events such as the collapse of an undercut or water saturated stream bank. As discussed below, tree throw is one of the major causes of feature disturbance and sediment mobilization in some upland settings.

TREE THROW

Tree throw (also known as treethrow, tree-throw, tree uprooting, tree fall, tree tip, tree topple, tree windthrow, root throw, floralturbation, arboturbation, and many other names) is the process by which an abnormal range of movement or collapse of a tree, shrub, or other large rooted plant disrupts the integrity of its substrate (Birkeland, 1984, p. 148-149; Schaetzl and others, 1989, p. 1-2; Waters, 1992, p. 306-308) is an important form of bioturbation. When a tree falls or sways violently, it may function as a lever, dislodging its roots and the adhering soil and rock. A falling or swaying tree may strike other plants or structures, as well, resulting in their collapse and further disturbance of the substrate.

"Floralturbation" and "arboturbation" are generic terms encompassing tree throw *per se* while acknowledging that "turbation" or substrate mixing also can be caused by *in situ* root growth and eventual decomposition. Trees have remarkably extensive root systems spreading laterally and vertically through the soil profile, and even into the subjacent bedrock. The developing root system penetrates and displaces the surrounding and underlying substrate, admixing the soil profile and its contents. Decomposition of roots creates underground voids allowing downward intrusion and collapse of soil and objects such as hearthstones or other artifacts. Other effects include: addition of organic matter; formation of humic acids; concentration of certain minerals; and generation of soil gases, particularly carbon dioxide, which dissolves in soil moisture to form a solution of carbonic acid that may leach soluble minerals. These processes influence the method and pace of pedogenesis and enhance both mechanical and chemical erosion of the subjacent bedrock and/or selected soil components. Root penetration has similar effects on both surficial and buried archeological sites.

In addition to soil disturbance, dead and even living healthy trees sometimes collapse. The resulting tree throw creates "pit and knoll (also "pit and mound" or "cradle and knoll") topography," produces stratigraphic and archeological anomalies, and disperses sediment above ground (see Figure E2). As the tree falls, it extracts a large mass of rock and soil particles held within the network of roots. The cavity left by the displaced mass is the "pit," which may become a locus of deposition. Any sediment and organic matter accumulating within the pit will be genetically and temporally distinct from that of the surrounding undisturbed soil horizons. A "knoll" forms at the edge of the cradle as the tree's roots decompose, freeing the displaced soil, which then falls to the ground. The resulting mound of loose sediment is subject to increased erosion, transport, and redeposition downslope. Eventually, all surficial traces of the pit and knoll will disappear, but stratigraphic evidence may persist.

In upland contexts, tree throw is often the principal means by which sediment is redistributed, allowing localized deposition and site burial even where there is no net sedimentation on the upland as a whole. Tree throw and related geomorphic processes thus play an important role in direct preservation of some archeological sites. It must be noted, however, that uprooting may damage or destroy other sites and produce anomalous groupings of artifacts of different ages or affinities within the pit, knoll, and downslope. All trees have finite life spans and thus, inevitably, promulgate this complex sequence of events. Mortality or damage caused by disease, drought, wind storms, insects, or fire increases the number of trees affected at any given time. Some forested areas may sustain complete disruption of their soil profile every few thousand years as a result of tree throw. Yet even in sparsely wooded locations, tree throw can have significant geoarcheological implications.

EOLIAN DEPOSITION AND DEFLATION

Sediment erosion, transport, and deposition by wind are among the principal geomorphic processes affecting many parts of the Earth, but are everywhere expressed to a degree (Ritter and others, 1995, p. 271-282). As a medium of conveyance, air is far less dense than water and is therefore restricted to moving fine-grained sediment. Like water, air transports sediment by saltation (bouncing), rolling, and sliding across the ground and by suspension at variable altitudes within the atmosphere. Comparatively dense and coarse-grained particles move along the ground when wind speeds are moderately high. Low-density, fine-grained sediment can be carried aloft and may drift thousands of kilometers.

In addition to sediment composition and texture and wind velocity, the most important factors influencing deflation (wind erosion) and transport include ground-surface cohesion, roughness, slope, and vegetative cover. In general, surface cohesion increases with soil moisture and clay content. Organic-rich and calcic soils also tend to be cohesive. By itself, wind normally cannot displace particles from a moderately cohesive surface, but human or animal disturbances such as excavation, plowing, and foot traffic disrupt cohesion and allow initiation of grain movement. The most easily entrained sediment is loose, dry sand (very fine to medium), coarse silt, and coarse silt-size agglomerations of clay. Coarser grains are too heavy to be moved readily except by very high winds, although grains as coarse as pebbles can be moved under special conditions. Grains finer than coarse silt present a cross-sectional area too small to allow aerodynamic lift.

Grains coarser than very fine sand generally cannot be transported in suspension. Instead, coarser particles move in continuous contact with the surface or bounce from point to point. Such movement is easiest when the surface is smooth and, ironically, cohesive. Rough surfaces interfere with movement because they create obstacles against which the sliding and rolling grains accumulate. Still greater roughness impedes saltation. Roughness also disrupts the continuity of laminar wind flow, such that the air moving at high velocity looses contact with the grains, causing them to settle back into static positions on the surface. Ground slope is important because changes of more than a few degrees increase the resisting forces as the ground rises and cause airflow detachment where the ground declines. Lastly, the above-ground portion of plants is a source of surface roughness and the roots aid cohesion. The leaves and branches of plants actually serve as a baffle, allowing some air to pass through but in effect, filter it by slowing its speed below the threshold required to maintain suspension. Trees are particularly effective eolian baffles.

Deflation, wind transport, and deposition require an appropriate source of sediment. The source need not be a vast unvegetated desert. In inland environments, one of the best primary sources is the flood plain of a stream with variable (“flashy”) discharge. Floods deposits large amounts of fine-grained sediment on the flat channel floors or flood plains of ephemeral and intermittent streams. That sediment is unvegetated and, when dry, is ideally suited for deflation. Virtually all eolian deposits in semiarid, sub humid, and even humid climates originate on the flood plains or broad channels of rivers or streams, or in comparable settings where other processes afford the same conditions. Not all eolian deposits are large dunes. Some are plains or steppes, others are small coppice dunes forming around shrubs or tufts of grass, and still others are essentially unrecognizable because they are mere components of soils in remote locations that routinely receive wind-borne, very fine-grained sediment.

A second study of erosion in Texas by the Soil Conservation Service (1985) produced estimates of deflation and sheet and rill erosion for each of the state’s Major Land Resource areas (physiographic regions), with separate tabulations for tracts with different land uses. Table E6 includes data extracted from this report that pertain to Webb County. There was considerable variation in the rates of deflation within each land-use class and even greater differences between classes. In rangelands, the rates varied from 0.0172 to 0.123 mm/yr, whereas cultivated croplands produced much higher rates of deflation, 1.050 to 5.880 mm/yr. Grazing and browsing animals reduce ground cover, especially around water sources and in other locations where they congregate, but they do not change the fundamental characteristics of the soil and ground surface over large areas. Cultivated croplands lack natural ground cover and are seasonally and episodically bare in winter and fallow periods. The process of tillage breaks the surface cohesion, exposing the underlying loose sediment and allowing it to dry. The soils most suited to cultivation are silty and sandy, which makes them subject to deflation. In addition, cultivation and harvesting create large amounts of dust that, because it is already airborne, is held in suspension by even gentle breezes. There is little doubt that cultivation greatly increases deflation in this area. This may increase the risk of damage to cultural resources, but the act of tillage may have made that danger moot. There was probably no time in the Prehistoric or Historic past when deflation levels approached those resulting from industrial-scale agriculture.

ANTHROPIC EFFECTS

Superimposed on the effects of geomorphic processes are a variety of human activities that have modified the landscape in ways comparable to or exceeding those of extreme natural events. Anthropic impact began in Prehistory with simple hunting and gathering and occupational site development. These activities produced artifactual and other physical records, but generally had only modest and localized impact on the environment. Human-set fires may have damaged broader areas, yet typically did not exceed the effects of natural wildfires. Beginning in Late/Transitional Archaic time, agriculture and larger-scale earthmoving and construction by Native Americans increasingly modified the environment in many parts of North Americas, although effects in the Webb County project area appear to have been negligible. Intensive exploitation of land and water resources was manifest after European colonization and has accelerated to the present, both regionally and locally. The example of deflation resulting from crop cultivation serves to illustrate the scope of these effects.

The development of archeological sites in this area provided a record of divergent lifeways. Human

Table E6. Rates of wind erosion (deflation) and sheet and rill erosion (denudation) in Webb County, Texas, tabulated by Major Land Resource Area (MLRA) and principal land use.

All rates are estimates of mean erosion per annum

A MLRA	B Mg/hm^2	C m^3/hm^2	D mm/yr
WIND EROSION (DEFLATION)			
Rangeland			
Northern Rio Grande Plain	0.22	0.172	0.0172
Western Rio Grande Plain	0.44	0.343	0.0343
Central Rio Grande plain	1.57	1.225	0.1225
Cultivated Cropland			
Northern Rio Grande Plain	13.45	10.497	1.0500
Western Rio Grande Plain	16.81	13.118	1.3100
Central Rio Grande plain	75.32	58.779	5.8800
SHEET AND RILL EROSION			
Rangeland			
Northern Rio Grande Plain	1.57	1.225	0.123
Western Rio Grande Plain	1.80	1.405	0.141
Central Rio Grande plain	1.35	1.054	0.105
Cultivated Cropland			
Northern Rio Grande Plain	7.85	6.126	0.613
Western Rio Grande Plain	4.26	3.324	0.332
Central Rio Grande plain	8.97	7.000	0.700

Footnotes

A: Data are from Soil Conservation Service (1985, Tables 16c, 19c). The data were originally expressed in English units of measurement, which are here converted to their metric equivalents. Conversion introduces minute numerical errors caused by rounding, and although these errors compound, the data should not be unduly compromised. All reported values represent annual sediment losses. A Major Land Resource Area (MLRA) is a natural division of the landscape, characterized by relatively uniform conditions within that area, but somewhat contrasting with conditions in adjacent areas (Soil Conservation Service, 1981). Erosion was estimated using the Universal Soil-loss Equation, calibrated for observed sediment losses at selected monitoring stations across Texas. Sediment yields caused by wind erosion (deflation) are tabulated separately from those caused by sheet and rill erosion.

B: "Mg/hm^2" denotes mean sediment loss in megagrams per square hectometer (i.e., mass per unit area). A square hectometer is sometimes referred to as a hectare. The erosional data were originally reported in tons per acre (ton/ac), which were converted by multiplying the number of ton/ac by 2.2417.

C: "m^3/hm^2" denotes mean sediment loss in cubic meters per square hectometer (i.e., volume per unit area), based on a mean sediment density of 1.2814 Mg/m^3 (Leopold and others, 1964, App. A).

D. "mm/yr" denotes mean sediment loss in millimeters (i.e., thickness) per year, assuming uniform losses throughout the MLRA.

activities shaped the sites to their purpose and as the purpose changed, the shape changed. The record is imperfect and continues to evolve. Human influence over the environment at large is now so profound that even long after a site was abandoned, it has come under the influence of other men who may never have been there. Geomorphic processes that preserve, modify, or destroy sites are subject to these same influences. The possible effects of erosion by running water could be modified by the newly constructed reservoir upstream.

CONCLUSIONS

A review of the conceptual definition of a "site" disclosed the dual influences of anthropic activities and geomorphic processes. These processes prepared the land for occupation, competed with human endeavors during site development, and safeguard or threaten the site today. By quantifying the mechanisms of landscape evolution, we may better understand the changing capacity of humans to alter their environment. That capacity is the consummate attribute of mankind.

Prehistoric archeological sites throughout the project area face daunting challenges during their epigenesis (see Figure E1). Upland and tributary-valley sites are especially at risk, from the effects of natural landscape reversion as well as the escalating pressures of modern land use. The model of site development presented here explores the relationship between human enterprises and geomorphic processes and the fluid role of each. Sites evolve because of these influences: from before its initial human presence, through intensive modification of the environment, declining anthropic activity and abandonment, and post-abandonment alteration of the accrued archeological record. Data regarding the rates at which natural processes operate enlighten the present status of archeological sites and the forces affecting their destiny.

REFERENCES CITED

Anonymous
1971 *The Compact Edition of the Oxford English Dictionary*, Oxford University Press, Oxford, England.

Birkeland, P. W.
1984 *Soils and geomorphology*: Oxford University Press, New York, New York.

Blatt, Harvey, Middleton, Gerard, and Murray, Raymond
1980 *Origin of sedimentary rocks*, 2nd ed.: Englewood Cliffs, New Jersey, Prentice-Hall, Inc

Buckner, H. D., and Shelby, W. J.
1991 *Water resources data, Texas, water year 1991, vol. 3*: Austin, Texas, United States Department of the Interior, Geological Survey Water-Data Report TX-91–3.

Caran, S. C.
1994a Appendix B. Quaternary stratigraphy and geomorphology of the Farco mine prospect [later known as the Trenino mining permit area], Webb County, Texas, p. 96–117 in Warren, J. E. (with a contribution by S. C. Caran), *A cultural resources survey of the Trevino Mining Permit area, Webb County, Texas* Archaeology Consultants, Inc. Report 235,George West, Texas,

Caran, S. C.
1994b Appendix D. Quaternary stratigraphy and geomorphology of the Texas A&M University International Campus, Laredo, Webb County, Texas, p. 53–71 in Warren, J. E., *Subsurface testing portions of archeological sites 41WB362 and 41WB363, Texas A&M University International Campus, Laredo, Webb County, Texas.* Archaeology Consultants, Inc. Report 390, George West, Texas.

Caran, S. C.
1995 Appendix A. Quaternary stratigraphy and geomorphology of the South Laredo Affordable Housing Project, Laredo, Webb County, Texas, p. A.1-A.18 in Moore, W. E., and J. E. Warren (with a contribution by S. C. Caran), *Significance testing of archeological site 41WB383, the South Texas Affordable Housing Project—Webb County, Texas*. George West, Texas, Archaeology Consultants, Inc. Report Number 392.

Caran, S. C.
1998 Appendix 1. Geomorphology of site 41WB416 in the proposed Father McNaboe (Deerfield) Recreational Complex, Laredo, Webb County, Texas, p, 56–71 in McCulloch, S. D., and Warren, J. E., *A report on the limited National Register testing of site 41WB416, Laredo, Webb County, Texas.* George West, Texas, Archaeology Consultants, Inc. Report Number 477.

Caran, S. C.
1999 Geomorphology of the Rachal Lease, p. 20-31 in Turpin, Jeff, and Caran, S. C., *National Register of Historic Places eligibility testing of six prehistoric sites in the Rachal Lease, Webb County, Texas.* Austin, Texas, TAS, Inc. Cultural Resources Report 14.

Caran, S. C., and Baker, V. E.
1986 Flooding along the Balcones Escarpment, central Texas, p. 1–14, in Abbott, P. L., and C. M. Woodruff, Jr., editors, *The Balcones Escarpment* Comet Reproduction Service, Santa Fe Springs, California.

Caran, S. C., and Eling, H. H., Jr.
1992 *Cultural resource assessment of the proposed Delhi Pemex Pipeline corridor, Webb County, Texas* Galvan Eling and Associates, Inc, Austin, Texas.

Caran, S. C., and Turpin, Jeff
1995 *Geomorphological and archeological investigations in Webb County—the Trevino Lease.* TAS, Inc, Austin, Texas.

Collins, M. B.
1992 Appendix. Geoarchaeological investigations, in Warren, J. E., *Significance testing of three archeological sites in the Rachal Mine Permit Area, Webb County, Texas*: George West, Texas, Archaeology Consultants, Inc. Report Number 232.

Collins, M. B.
1995 Forty years of archeology in central Texas, in *Bulletin of the Texas Archeological Society* 66(361–400).

Davis, M. W.
1992 *Archeological sites along the Camino Columbia: A proposed toll road in Webb County, Texas*: Austin, Texas, Hicks & Company, Inc. Archeology Series 12.

Fagan, B. M.
1989 *People of the Earth*, 6th ed. Glenview, Illinois, Scott, Foresman and Company.

Geologic Names Committee
2007 *Divisions of geologic time--Major chronostratigraphic and geochronologic units*. Reston, Virginia, United States Department of the Interior, Geological Survey Fact Sheet 2007–3015.

Geological Survey
1985 *State of Texas*. Washington, D. C., United States Department of the Interior (topographic map, 1:1,000,000-scale).

Greiner, J. H., Jr.
1982 *Erosion and sedimentation by water in Texas--Average annual rates estimated in 1979.* Austin, Texas, Texas Department of Water Resources Report 268.

Hairsine, P. B. and Rose, C. W.
1991 Rainfall detachment and deposition: Sediment transport in the absence of flow-driven processes: *Soil Science Society of America Journal* 55(320–324).

Hester, T. R., Shafer, H. J., and Feder, K. L.
1997 *Field Methods in Archaeology*, 7th ed.: Mountain View, California, Mayfield Publishing Company.

Holloway, R. G.
1989 Experimental mechanical pollen degradation and its application to Quaternary age deposits: *Texas Journal of Science*, v. 41, p. 131-145.

Middleton, G. V., and Southard, J. B.
1984 *Mechanics of sediment movement*, 2nd ed.: Tulsa, Oklahoma, Society of Economic Paleontologists and Mineralogists Short Course No. 3, pages not numbered continuously.

Nordt, L. C.
2000 Chapter 3: Late Quaternary stratigraphy and geoarchaeology, p. 21–32, in Miller, K. A., Carpenter, Steve, Nordt, L. C., and Ringstaff, C. W., *Archaeological investigations along the Camino Columbia Toll Road, Webb County, Texas*: Austin, Texas, SWCA, Inc., SWCA Cultural Resources Report No. 97–120.

Patterson, J. L.
1965 *Magnitude and frequency of floods in the United States*. Part 8. Western Gulf of Mexico basins: Washington, D. C., United States Department of the Interior, Geological Survey Water-Supply Paper 1682.

Quigg, J. M., Chris Lintz, Grant Smith, and Scott Wilcox
2000 *The Lino site: A stratified Late Archaic campsite in a terrace of the San Idelfonzo Creek, Webb County, southern Texas*. Austin, Texas, TRC Mariah Associates, Inc. Technical Report No. 23756.

Riding, R. E., and Awramik, S. M. eds.
2000 *Microbial sediments.* Berlin, Germany, Springer.

Ritter, D. F., Kochel, R. C., and Miller, J. R.
1995 *Process geomorphology*, 3rd ed. Wm. C. Brown Publishers. Dubuque, Iowa.

Roberson, J. A., and Crowe, C. T.
1975 *Engineering fluid mechanics*. Boston, Massachusetts, Houghton Mifflin Company.

Schaetzl, R. J., Johnson, D. L., Burns, S. F., and Small, T. W.
1989 Tree uprooting--Review of terminology, process, and environmental implications. *Canadian Journal of Forest Research* 19(1–11).

Slade, R. M., Jr., and Patton, John
2003 *Major and catastrophic storms and floods in Texas.* Washington, D. C., United States Department of the Interior, Geological Survey Open-File Report 03–193, Version 1.1.

Soil Survey Staff
1999 *Soil taxonomy*, 2nd ed. : Washington, D.C., United States Department of Agriculture,

Natural Resources Conservation Service Agriculture Handbook 436.

Soil Conservation Service
1985 *Texas--1982 National Resources Inventory statistical tables.* Temple, Texas, United States Department of Agriculture.

Strahler, A. N.
1963 *The earth sciences.* New York, New York, Harper & Row, Publishers.

Terrell, Peter, ed.
1996 *Harrap's Shorter Dictionary*: English-French/French-English (Harrap's Shorter Dictionnaire: Anglais-Français/Français- Anglais): Edinburgh, Scotland, Chambers Harrap Publishers Ltd.

Turpin, Jeff, and Caran, S. C.
1999 *National Register of Historic Places eligibility testing of six prehistoric sites in the Rachal Lease, Webb County, Texas.* Austin, Texas, TAS, Inc. Cultural Resources Report 14.

Walker, R. G., and Cant, D. J.
1984 Sandy fluvial systems, p. 71–89 in Walker, R. G., ed., *Facies models*, 2nd ed.: Toronto, Canada, Geological Association of Canada, Geoscience Canada Reprint Series 1.

Water Resources Division
1949 *Large rivers of the United States*. Washington, D. C., United States Department of the Interior, Geological Survey Circular 44.

Waters, M. R.
1992 *Principles of geoarchaeology, a North American perspective*. Tucson, Arizona, University of Arizona Press.

Woolf, H. B., ed.
1975 *Webster's New Collegiate Dictionary.* Springfield, Massachusetts, G. & C. Merriam Company.

Appendix F
Specimen Inventory
Cuatro Vientos Feature Data
Webb County Projectile Points List
Webb County Nueces Sites Data

Site	Settng	Type	Class	#	Age
41WB9	Surface	Abasolo	Projectile Point	3	Late Middle Archaic
41WB13	Surface	Abasolo	Projectile Point	1	Late Middle Archaic
41WB15	Surface	Abasolo	Projectile Point	3	Late Middle Archaic
41WB17	Subsurface	Abasolo	Projectile Point	1	Late Middle Archaic
41WB17	Surface	Abasolo	Projectile Point	3	Late Middle Archaic
41WB43	Surface	Abasolo	Projectile Point	1	Late Middle Archaic
41WB44	Surface	Abasolo	Projectile Point	1	Late Middle Archaic
41WB60	Surface	Abasolo	Projectile Point	2	Late Middle Archaic
41WB74	Surface	Abasolo	Projectile Point	1	Late Middle Archaic
41WB76	Surface	Abasolo	Projectile Point	1	Late Middle Archaic
41WB131	Surface	Abasolo	Projectile Point	1	Late Middle Archaic
41WB144	Surface	Abasolo	Projectile Point	1	Late Middle Archaic
41WB144	Surface	Abasolo	Projectile Point	1	Late Middle Archaic
41WB206	Subsurface	Abasolo	Projectile Point	1	Late Middle Archaic
41WB313	Surface	Abasolo	Projectile Point	1	Late Middle Archaic
41WB314	Surface	Abasolo	Projectile Point	1	Late Middle Archaic
41WB361	Surface	Abasolo	Projectile Point	2	Late Middle Archaic
41WB364	Surface	Abasolo	Projectile Point	1	Late Middle Archaic
41WB368	Surface	Abasolo	Projectile Point	1	Late Middle Archaic
41WB379	Surface	Abasolo	Projectile Point	1	Late Middle Archaic
41WB413	Surface	Abasolo	Projectile Point	1	Late Middle Archaic
41WB438	Surface	Abasolo	Projectile Point	1	Late Middle Archaic
41WB556	Subsurface	Abasolo	Projectile Point	4	Late Middle Archaic
41WB557	Surface	Abasolo	Projectile Point	1	Late Middle Archaic
41WB557	Subsurface	Abasolo	Projectile Point	9	Late Middle Archaic
41WB563	Surface	Abasolo	Projectile Point	1	Late Middle Archaic
41WB565	Surface	Abasolo	Projectile Point	1	Late Middle Archaic
41WB596	Surface	Abasolo	Projectile Point	1	Late Middle Archaic
41WB616	Surface	Abasolo	Projectile Point	1	Late Middle Archaic
41WB617	Surface	Abasolo	Projectile Point	1	Late Middle Archaic
41WB43	Surface	Almagre	Projectile Point	1	Early Middle Archaic
41WB557	Subsurface	Almagre	Projectile Point	1	Early Middle Archaic
41WB557	Subsurface	Anthon	Projectile Point	5	Early Archaic
41WB42	Surface	Arrow Point-Untyped	Projectile Point	1	Late Prehistoric
41WB44	Surface	Arrow Point-Untyped	Projectile Point	1	Late Prehistoric
41WB49	Surface	Arrow Point-Untyped	Projectile Point	1	Late Prehistoric
41WB219	Subsurface	Arrow Point-Untyped	Projectile Point	1	Late Prehistoric
41WB236	Surface	Arrow Point-Untyped	Projectile Point	1	Late Prehistoric
41WB272	Surface	Arrow Point-Untyped	Projectile Point	1	Late Prehistoric
41WB295	Surface	Arrow Point-Untyped	Projectile Point	1	Late Prehistoric
41WB306	Surface	Arrow Point-Untyped	Projectile Point	1	Late Prehistoric
41WB316	Surface	Arrow Point-Untyped	Projectile Point	2	Late Prehistoric
41WB316	Surface	Arrow Point-Untyped	Projectile Point	4	Late Prehistoric
41WB336	Surface	Arrow Point-Untyped	Projectile Point	1	Late Prehistoric
41WB397	Surface	Arrow Point-Untyped	Projectile Point	1	Late Prehistoric
41WB556	Subsurface	Arrow Point-Untyped	Projectile Point	3	Late Prehistoric
41WB557	Subsurface	Arrow Point-Untyped	Projectile Point	24	Late Prehistoric
41WB615	Surface	Arrow Point-Untyped	Projectile Point	1	Late Prehistoric
41WB415	Surface	Bell	Projectile Point	1	Early Archaic
41WB557	Subsurface	Bell	Projectile Point	1	Early Archaic

Site	Settng	Type	Class	#	Age
41WB13	Burned Rock Cluster	Beveled Triangular Point	Projectile Point	1	Not diagnostic
41WB131	Surface	Bulverde	Projectile Point	1	Early Middle Archaic
41WB615	Surface	Cameron	Projectile Point	1	Late Prehistoric
41WB616	Surface	Cameron	Projectile Point	1	Late Prehistoric
41WB556	Subsurface	Caracara	Projectile Point	3	Late Prehistoric
41WB557	Subsurface	Caracara	Projectile Point	3	Late Prehistoric
41WB578	Subsurface	Caracara	Projectile Point	1	Late Prehistoric
41WB492	Surface	Caracaras	Projectile Point	1	Late Prehistoric
41WB514	Surface	Carrizo	Projectile Point	1	Late Middle Archaic
41WB367	Surface	Castroville	Projectile Point	1	Late Archaic
41WB9	Surface	Catan	Projectile Point	2	Transitional Archaic
41WB13	Surface	Catan	Projectile Point	1	Transitional Archaic
41WB15	Surface	Catan	Projectile Point	1	Transitional Archaic
41WB88	Surface	Catan	Projectile Point	1	Transitional Archaic
41WB101	Surface	Catan	Projectile Point	2	Transitional Archaic
41WB138	Surface	Catan	Projectile Point	1	Transitional Archaic
41WB140	Surface	Catan	Projectile Point	1	Transitional Archaic
41WB206	Surface	Catan	Projectile Point	1	Transitional Archaic
41WB236	Surface	Catan	Projectile Point	1	Transitional Archaic
41WB272	Surface	Catan	Projectile Point	2	Transitional Archaic
41WB314	Not noted	Catan	Projectile Point	1	Transitional Archaic
41WB363	Subsurface	Catan	Projectile Point	1	Transitional Archaic
41WB365	Surface	Catan	Projectile Point	1	Transitional Archaic
41WB366	Surface	Catan	Projectile Point	1	Transitional Archaic
41WB368	Surface	Catan	Projectile Point	1	Transitional Archaic
41WB377	Surface	Catan	Projectile Point	2	Transitional Archaic
41WB379	Surface	Catan	Projectile Point	3	Transitional Archaic
41WB412	Surface	Catan	Projectile Point	1	Transitional Archaic
41WB437	Subsurface	Catan	Projectile Point	1	Transitional Archaic
41WB462	Surface	Catan	Projectile Point	1	Transitional Archaic
41WB463	Surface	Catan	Projectile Point	1	Transitional Archaic
41WB473	Surface	Catan	Projectile Point	1	Transitional Archaic
41WB492	Surface	Catan	Projectile Point	1	Transitional Archaic
41WB504	Surface	Catan	Projectile Point	1	Transitional Archaic
41WB509	Surface	Catan	Projectile Point	1	Transitional Archaic
41WB528	Surface	Catan	Projectile Point	1	Transitional Archaic
41WB563	Surface	Catan	Projectile Point	1	Transitional Archaic
41WB594	Surface	Catan	Projectile Point	1	Transitional Archaic
41WB616	Surface	Catan	Projectile Point	1	Transitional Archaic
41WB448	Surface	Catan/Refugio	Projectile Point	1	Transitional Archaic
41WB557	Subsurface	Cliffton	Projectile Point	1	Late Prehistoric
41WB519	Surface	Dart Point	Projectile Point	1	Indeterminate
41WB9	Surface	Desmuke	Projectile Point	1	Late Archaic
41WB23	Surface	Desmuke	Projectile Point	1	Late Archaic
41WB69	Surface	Desmuke	Projectile Point	2	Late Archaic
41WB71	Surface	Desmuke	Projectile Point	2	Late Archaic
41WB103	Surface	Desmuke	Projectile Point	1	Late Archaic
41WB308	Surface	Desmuke	Projectile Point	1	Late Archaic
41WB314	Surface	Desmuke	Projectile Point	1	Late Archaic
41WB329	Surface	Desmuke	Projectile Point	1	Late Archaic

Site	Settng	Type	Class	#	Age
41WB333	Surface	Desmuke	Projectile Point	1	Late Archaic
41WB363	Surface	Desmuke	Projectile Point	3	Late Archaic
41WB368	Surface	Desmuke	Projectile Point	1	Late Archaic
41WB462	Surface	Desmuke	Projectile Point	1	Late Archaic
41WB480	Surface	Desmuke	Projectile Point	1	Late Archaic
41WB531	Surface	Desmuke	Projectile Point	1	Late Archaic
41WB557	Subsurface	Desmuke	Projectile Point	4	Late Archaic
41WB563	Surface	Desmuke	Projectile Point	1	Late Archaic
41WB615	Surface	Desmuke	Projectile Point	3	Late Archaic
41WB617	Surface	Desmuke	Projectile Point	2	Late Archaic
41WB618	Surface	Desmuke	Projectile Point	2	Late Archaic
41WB557	Subsurface	Devils Triangle	Projectile Point	1	Early Archaic
41WB458	Surface	Early Triangular	Projectile Point	1	Early Archaic
41WB488	Surface	Early Triangular	Projectile Point	1	Early Archaic
41WB493	Surface	Early Triangular	Projectile Point	2	Early Archaic
41WB504	Surface	Early Triangular	Projectile Point	1	Early Archaic
41WB20	From Arroyo Walls	Edgewood	Projectile Point	1	Transitional Archaic
41WB414	Surface	Edgewood	Projectile Point	1	Transitional Archaic
41WB557	Subsurface	Edwards	Projectile Point	1	Late Prehistoric
41WB9	Surface	Ensor	Projectile Point	1	Transitional Archaic
41WB42	Surface	Ensor	Projectile Point	1	Transitional Archaic
41WB129	Subsurface	Ensor	Projectile Point	1	Transitional Archaic
41WB136	Surface	Ensor	Projectile Point	1	Transitional Archaic
41WB138	Surface	Ensor	Projectile Point	1	Transitional Archaic
41WB272	Surface	Ensor	Projectile Point	2	Transitional Archaic
41WB519	Surface	Ensor	Projectile Point	1	Transitional Archaic
41WB578	Subsurface	Ensor	Projectile Point	1	Transitional Archaic
41WB13	Surface	Ensor-like	Projectile Point	1	Transitional Archaic
41WB136	Surface	Figueroa	Projectile Point	1	Late Archaic
41WB9	Surface	Fresno	Projectile Point	1	Late Prehistoric
41WB136	Surface	Fresno	Projectile Point	1	Late Prehistoric
41WB136	Surface	Fresno	Projectile Point	1	Late Prehistoric
41WB361	Surface	Fresno	Projectile Point	1	Late Prehistoric
41WB441	Surface	Fresno	Projectile Point	1	Late Prehistoric
41WB525	Surface	Fresno	Projectile Point	1	Late Prehistoric
41WB557	Subsurface	Fresno	Projectile Point	1	Late Prehistoric
41WB43	Surface	Frio	Projectile Point	1	Transitional Archaic
41WB313	Surface	Frio	Projectile Point	1	Transitional Archaic
41WB485	Surface	Frio	Projectile Point	1	Transitional Archaic
41WB42	Surface	Gary	Projectile Point	1	Late Middle Archaic
41WB487	Surface	Gower	Projectile Point	1	Early Archaic
41WB316	Surface	Guerrero	Projectile Point	1	Late Prehistoric
41WB613	Surface	Guerrero	Projectile Point	1	Late Prehistoric
41WB438	Surface	Kinney	Projectile Point	3	Early Middle Archaic
41WB486	Surface	Lange	Projectile Point	1	Early Middle Archaic
41WB60	Surface	Langtry	Projectile Point	1	Early Middle Archaic
41WB557	Subsurface	Langtry	Projectile Point	4	Early Middle Archaic
41WB578	Subsurface	Langtry	Projectile Point	1	Early Middle Archaic
41WB578	Subsurface	Langtry	Projectile Point	1	Early Middle Archaic
41WB563	Surface	Lerma	Projectile Point	1	Not diagnostic

Site	Settng	Type	Class	#	Age
41WB615	Surface	Lerma	Projectile Point	5	Not diagnostic
41WB616	Surface	Lerma	Projectile Point	2	Not diagnostic
41WB617	Surface	Lerma	Projectile Point	2	Not diagnostic
41WB618	Surface	Lerma	Projectile Point	2	Not diagnostic
41WB361	Surface	Lerma-like	Projectile Point	1	Not diagnostic
41WB438	Surface	Lozenge	Projectile Point	1	Late Prehistoric
41WB9	Surface	Matamoros	Projectile Point	1	Transitional Archaic
41WB42	Surface	Matamoros	Projectile Point	1	Transitional Archaic
41WB43	Surface	Matamoros	Projectile Point	3	Transitional Archaic
41WB89	Surface	Matamoros	Projectile Point	1	Transitional Archaic
41WB91	Surface	Matamoros	Projectile Point	1	Transitional Archaic
41WB98	Surface	Matamoros	Projectile Point	1	Transitional Archaic
41WB130	Surface	Matamoros	Projectile Point	1	Transitional Archaic
41WB236	Surface	Matamoros	Projectile Point	1	Transitional Archaic
41WB236	Surface	Matamoros	Projectile Point	1	Transitional Archaic
41WB314	Surface	Matamoros	Projectile Point	1	Transitional Archaic
41WB329	Subsurface	Matamoros	Projectile Point	1	Transitional Archaic
41WB361	Surface	Matamoros	Projectile Point	1	Transitional Archaic
41WB363	Surface	Matamoros	Projectile Point	2	Transitional Archaic
41WB364	Surface	Matamoros	Projectile Point	2	Transitional Archaic
41WB365	Surface	Matamoros	Projectile Point	1	Transitional Archaic
41WB367	Surface	Matamoros	Projectile Point	1	Transitional Archaic
41WB379	Surface	Matamoros	Projectile Point	1	Transitional Archaic
41WB400	Surface	Matamoros	Projectile Point	1	Transitional Archaic
41WB414	Surface	Matamoros	Projectile Point	1	Transitional Archaic
41WB437	Subsurface	Matamoros	Projectile Point	1	Transitional Archaic
41WB450	Surface	Matamoros	Projectile Point	1	Transitional Archaic
41WB458	Surface	Matamoros	Projectile Point	1	Transitional Archaic
41WB488	Surface	Matamoros	Projectile Point	1	Transitional Archaic
41WB493	Surface	Matamoros	Projectile Point	1	Transitional Archaic
41WB504	Surface	Matamoros	Projectile Point	1	Transitional Archaic
41WB557	Subsurface	Matamoros	Projectile Point	6	Transitional Archaic
41WB612	Subsurface	Matamoros	Projectile Point	1	Transitional Archaic
41WB615	Surface	Matamoros	Projectile Point	1	Transitional Archaic
41WB617	Surface	Matamoros	Projectile Point	1	Transitional Archaic
41WB517	Surface	Matamoros/Tortugas	Projectile Point	1	Transitional Archaic
41WB487	Surface	Palmillas	Projectile Point	1	Early Archaic
41WB129	Feature	Palofax	Projectile Point	1	Late Prehistoric
41WB130	Surface	Palofax	Projectile Point	4	Late Prehistoric
41WB219	Subsurface	Palofax	Projectile Point	1	Late Prehistoric
41WB236	Surface	Palofax	Projectile Point	1	Late Prehistoric
41WB366	Surface	Palofax	Projectile Point	1	Late Prehistoric
41WB525	Surface	Pandora	Projectile Point	1	Not diagnostic
41WB9	Surface	Perdiz	Projectile Point	1	Late Prehistoric
41WB15	Surface	Perdiz	Projectile Point	2	Late Prehistoric
41WB80	Surface	Perdiz	Projectile Point	1	Late Prehistoric
41WB130	Surface	Perdiz	Projectile Point	1	Late Prehistoric
41WB295	Surface	Perdiz	Projectile Point	1	Late Prehistoric
41WB364	Surface	Perdiz	Projectile Point	1	Late Prehistoric
41WB413	Surface	Perdiz	Projectile Point	2	Late Prehistoric

Site	Settng	Type	Class	#	Age
41WB474	Surface	Perdiz	Projectile Point	1	Late Prehistoric
41WB492	Surface	Perdiz	Projectile Point	1	Late Prehistoric
41WB556	Subsurface	Perdiz	Projectile Point	1	Late Prehistoric
41WB557	Subsurface	Perdiz	Projectile Point	3	Late Prehistoric
41WB23	Surface	Plainview/Golondrina	Projectile Point	1	Paleo-Indian
41WB43	Surface	Possible Pandora/Refugio	Projectile Point	3	Not diagnostic
41WB13	Surface	Refugio	Projectile Point	1	Not diagnostic
41WB15	Surface	Refugio	Projectile Point	1	Not diagnostic
41WB17	Surface	Refugio	Projectile Point	1	Not diagnostic
41WB130	Surface	Refugio	Projectile Point	1	Not diagnostic
41WB314	Not Noted	Refugio	Projectile Point	1	Not diagnostic
41WB332	Surface	Refugio	Projectile Point	1	Not diagnostic
41WB360	Surface	Refugio	Projectile Point	1	Not diagnostic
41WB369	Surface	Refugio	Projectile Point	1	Not diagnostic
41WB437	Subsurface	Refugio	Projectile Point	5	Not diagnostic
41WB487	Surface	Refugio	Projectile Point	1	Not diagnostic
41WB496	Surface	Refugio	Projectile Point	1	Not diagnostic
41WB509	Surface	Refugio	Projectile Point	1	Not diagnostic
41WB512	Surface	Refugio	Projectile Point	1	Not diagnostic
41WB526	Surface	Refugio	Projectile Point	1	Not diagnostic
41WB556	Subsurface	Refugio	Projectile Point	2	Not diagnostic
41WB557	Subsurface	Refugio	Projectile Point	5	Not diagnostic
41WB571	Surface	Refugio	Projectile Point	1	Not diagnostic
41WB577	Surface	Refugio	Projectile Point	1	Not diagnostic
41WB578	Subsurface	Refugio	Projectile Point	1	Not diagnostic
41WB630	Surface	Refugio	Projectile Point	1	Not diagnostic
41WB15	Surface	Rio Bravo	Projectile Point	1	Undefined
41WB222	Subsurface	Scallorn	Projectile Point	1	Late Prehistoric
41WB316	Surface	Scallorn	Projectile Point	1	Late Prehistoric
41WB326	Surface	Scallorn	Projectile Point	1	Late Prehistoric
41WB458	Surface	Scallorn	Projectile Point	1	Late Prehistoric
41WB524	Surface	Scallorn	Projectile Point	1	Late Prehistoric
41WB325	Surface	Scallorn/Edwards	Projectile Point	1	Late Prehistoric
41WB14	Surface	Serrated Arrow Point	Projectile Point	1	Late Prehistoric
41WB15	Surface	Shumla	Projectile Point	1	Late Archaic
41WB303	Surface	Shumla	Projectile Point	1	Late Archaic
41WB326	Surface	Shumla	Projectile Point	1	Late Archaic
41WB458	Surface	Starr	Projectile Point	1	Late Prehistoric
41WB556	Subsurface	Starr	Projectile Point	3	Late Prehistoric
41WB557	Subsurface	Starr	Projectile Point	6	Late Prehistoric
41WB9	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB23	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB44	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB57	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB60	Surface	Tortugas	Projectile Point	3	Late Middle Archaic
41WB71	Surface	Tortugas	Projectile Point	2	Late Middle Archaic
41WB74	Surface	Tortugas	Projectile Point	2	Late Middle Archaic
41WB76	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB80	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB101	Surface	Tortugas	Projectile Point	2	Late Middle Archaic

Site	Settng	Type	Class	#	Age
41WB138	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB140	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB206	Subsurface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB212	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB219	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB236	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB270	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB272	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB295	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB298	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB299	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB300	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB304	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB308	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB310	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB313	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB314	Surface and Subsurface	Tortugas	Projectile Point	27	Late Middle Archaic
41WB316	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB316	Subsurface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB324	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB326	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB328	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB361	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB363	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB363	Subsurface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB364	Surface	Tortugas	Projectile Point	2	Late Middle Archaic
41WB365	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB368	Surface	Tortugas	Projectile Point	2	Late Middle Archaic
41WB379	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB400	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB415	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB437	Subsurface	Tortugas	Projectile Point	13	Late Middle Archaic
41WB441	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB448	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB450	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB458	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB462	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB488	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB493	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB504	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB556	Subsurface	Tortugas	Projectile Point	5	Late Middle Archaic
41WB557	Subsurface	Tortugas	Projectile Point	49	Late Middle Archaic
41WB565	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB571	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB572	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB577	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB578	Subsurface	Tortugas	Projectile Point	4	Late Middle Archaic
41WB592	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB593	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB598	Surface	Tortugas	Projectile Point	1	Late Middle Archaic

Site	Settng	Type	Class	#	Age
41WB613	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB615	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB617	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB618	Surface	Tortugas	Projectile Point	2	Late Middle Archaic
41WB622	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB631	Surface	Tortugas	Projectile Point	1	Late Middle Archaic
41WB13	Surface	Tortugas/ Early Triangular	Projectile Point	1	Late Middle Archaic
41WB15	Surface	Tortugas/ Early Triangular	Projectile Point	3	Late Middle Archaic
41WB17	Surface	Tortugas/ Early Triangular	Projectile Point	1	Late Middle Archaic
41WB414	Surface	Toyah	Projectile Point	1	Late Prehistoric
41WB458	Surface	Toyah	Projectile Point	1	Late Prehistoric
41WB556	Subsurface	Toyah	Projectile Point	3	Late Prehistoric
41WB557	Subsurface	Toyah	Projectile Point	1	Late Prehistoric
41WB594	Surface	Toyah	Projectile Point	1	Late Prehistoric
41WB623	Surface	Toyah	Projectile Point	1	Late Prehistoric
41WB58	Surface	Unstemmed	Projectile Point	1	Not diagnostic
41WB9	Surface	Untyped	Projectile Point	2	Indeterminate
41WB15	Surface	Untyped	Projectile Point	2	Indeterminate
41WB47	Surface	Untyped	Projectile Point	3	Indeterminate
41WB53	Surface	Untyped	Projectile Point	3	Indeterminate
41WB74	Surface	Untyped	Projectile Point	1	Indeterminate
41WB272	Surface	Untyped	Projectile Point	1	Indeterminate
41WB295	Surface	Untyped	Projectile Point	1	Indeterminate
41WB296	Surface	Untyped	Projectile Point	1	Indeterminate
41WB297	Surface	Untyped	Projectile Point	1	Indeterminate
41WB310	Surface	Untyped	Projectile Point	1	Indeterminate
41WB316	Surface	Untyped	Projectile Point	4	Indeterminate
41WB413	Surface	Untyped	Projectile Point	1	Indeterminate
41WB437	Subsurface	Untyped	Projectile Point	5	Indeterminate
41WB438	Surface	Untyped	Projectile Point	1	Indeterminate
41WB441	Surface	Untyped	Projectile Point	1	Indeterminate
41WB513	Surface	Untyped	Projectile Point	1	Indeterminate
41WB556	Subsurface	Untyped	Projectile Point	6	Indeterminate
41WB556	Subsurface	Untyped	Projectile Point	4	Indeterminate
41WB556	Subsurface	Untyped	Projectile Point	3	Indeterminate
41WB557	Subsurface	Untyped	Projectile Point	26	Indeterminate
41WB577	Surface	Untyped	Projectile Point	1	Indeterminate
41WB578	Subsurface	Untyped	Projectile Point	1	Indeterminate
41WB622	Surface	Untyped	Projectile Point	2	Indeterminate
41WB302	Surface	Untyped	Projectile Point	2	Indeterminate
41WB306	Surface	Untyped	Projectile Point	2	Indeterminate
41WB307	Surface	Untyped	Projectile Point	1	Indeterminate
41WB309	Surface	Untyped	Projectile Point	3	Indeterminate
41WB316	Surface	Untyped	Projectile Point	1	Indeterminate
41WB321	Surface	Untyped	Projectile Point	1	Indeterminate
41WB336	Surface	Untyped	Projectile Point	1	Indeterminate
41WB519	Surface	Untyped	Projectile Point	1	Indeterminate
Total				626	

Site	Feature No.	Feature Type	Max Diameter	Temporal Affiliation	Basis for Determination	Rock Types	Degree of Fracture	Clast Arrangment	Plan Shape	Profile Shape	Burned Rock (0-5 cm)		Burned Rock (5-10 cm)		Burned Rock (10-15 cm)		Burned Rock (15+cm)		Total Count	Total Wt in kg
											Count	Wt in kg	Count	Wt in kg	Count	Wt in kg	Count	Wt in kg		
41WB441	1	Rock-lined hearth	ca 100 cm	Late Middle Archaic	2320 B.P C-14 date	Chert (4) and Sandstone (131)	Mostly Unfractured	Adjacent with slight overlap.	Ovate	Slight basin	59	0.41	51	9.9	20	10.8	5	7.7	135	28.81
	2	Burned-rock hearth	50 cm	Late Prehistoric	390 B.P C-14 date	Sandstone	Highly fragmented	Dispersed	Ovate	Suggested slight basin	11	0.15	10	1.5	3	0.57	0	0	24	2.22
	3	Ash plume/ toss zone*	35 cm	NA	NA	None	N/A	N/A	None	None	0	0	0	0	0	0	0	0	0	0
41WB572	1	Burned rock scatter	100 cm	NA	NA	Sandstone	Unfractured	Adjacent	Eroded	Eroded	50+		30+		2				82+	
	2	Burned-rock hearth	100 cm	NA	NA	Sandstone	Highly fragmented	Adjoining	Circular	Shallow basin	100+		60+		5				165+	
	3	Burned rock hearth	70 cm	NA	NA	Chert, Sandstone, Quartzite	Mostly Unfractured	Adjoining	Circular	None	97	1.4	11	1.8	0	0	0	0	108	3.2
41WB577	1	Burned rock cluster	circa 60 cm	Transitional Archaic	1670 B.P. C-14 date	Chert (5) and Sandstone (15)	Mostly Unfractured	Adjoining	Circular	None	9	1.1	11	1.6	0	0	0	0	20	2.7
41WB578	1	Burned rock hearth	50 cm	NA	NA	Sandstone	Fractured in situ	Adjoining	Circular	None	1	0.05	10	2	2	0.6	1	0.9	14	3.55
	2	Burned rock cluster	74 cm	Early Middle Archaic	4150 B.P. C-14 date	Sandstone	Mostly Unfractured	Adjoining	Ovate	Slight basin	16	1.4	66	1.8	0	0	0	0	82	3.2
41WB622	1	Burned rock scatter	150 cm	NA	NA	Sandstone	Highly fragmented	Dispersed	Eroded	Eroded	73		23		5				101	
	2	Burned rock cluster	85 cm	NA	NA	Sandstone	Mostly Unfractured	Dispersed	Eroded	Eroded	6		12		5				23	
41WB623**	4	Burned rock scatter	150 cm	NA	NA	Chert, Sandstone, Quartzite	Fractured	Adjacent	Circular and eroded	None	150+		15+						165+	
	5	Lithic Reduction Locale	5-m^2	NA	NA	Chert	N/A	N/A	N/A	N/A										
	6	Burned rock cluster	95 cm	NA	NA	Chert, Sandstone, Quartzite	Mostly Unfractured	Adjacent	Eroded	None	20+		10+						30+	

* Likely in association with Feature 2

** Feature 1, 2, and 3 were identified during the initial survey.

Site	Lot No.	FS No.	BHT	UI No.	Feature	SC No.	Test Unit	Level	Depth (cmbs)	Provenience	Artifact Category	Artifact Type	Artifact Description	No. of Spec.	Weight in grams	Recorders	Date	Comments	Box	Bag
41WB441	1	2	1		n/a	n/a	1	1	0-10		Lithic	Burned Rock	burned rock	17		C.M./E.W.	05/12/05	0-5 cm		
41WB441	1	2	1		n/a	n/a	1	1	0-10		Lithic	Debitage	debitage	6	3	C.M./E.W.	05/12/05		BB 1 of 4	Bag 1
41WB441	2	9	1		n/a	n/a	1	2	10-20		Lithic	Burned Rock	burned rock	72		C.M./E.W.	05/12/05	71, 0-5 cm; 1, 5-10 cm		
41WB441	2	9	1		n/a	n/a	1	2	10-20		Lithic	Debitage	debitage	19	13	C.M./E.W.	05/12/05		BB 1 of 4	Bag 1
41WB441	3	10	1		n/a	n/a	1	3	20-30		Lithic	Burned Rock	burned rock	24		C.M./E.W.	05/12/05	0-5 cm		
41WB441	3	10	1		n/a	n/a	1	3	20-30		Lithic	Debitage	debitage	3	2	C.M./E.W.	05/12/05		BB 1 of 4	Bag 1
41WB441	4	10	1		n/a	n/a	1	3	20-30	N 17 E 63	Organic	Fauna	mussell shell	1	3	C.M./E.W.	05/12/05		BB 1 of 4	Bag 1
41WB441	5	11	1		n/a	n/a	1	4	30-40		Lithic	Burned Rock	burned rock	43		C.M./E.W.	05/12/05	34, 0-5 cm; 4, 5-10 cm		
41WB441	5	11	1		n/a	n/a	1	4	30-40		Lithic	Debitage	debitage	3	3	C.M./E.W.	05/12/05		BB 1 of 4	Bag 1
41WB441	6	13	1		n/a	n/a	1	5	40-50		Lithic	Burned Rock	burned rock	6		C.M./E.W.	05/12/05	3, 0-5 cm; 2, 5-10 cm; 1, 10-15 cm		
41WB441	6	13	1		n/a	n/a	1	5	40-50		Lithic	Debitage	debitage	4	3	C.M./E.W.	05/12/05		BB 1 of 4	Bag 1
41WB441	7	12	1		1 North	n/a	1	5	40-50		Lithic	Burned Rock	burned rock			C.M./E.W.	05/12/05			
41WB441	7	12	1		1 North	n/a	1	5	40-50		Lithic	Debitage	debitage	1	0.5	C.M./E.W.	05/12/05		BB 1 of 4	Bag 1
41WB441	7	12	1		1 North	n/a	1	5	40-50	South Bisect	Special	Soil Sample	pollen sample	1	362.7	C.M./E.W.	05/12/05	Sent for Analysis		
41WB441	7	12	1		1 North	n/a	1	5	40-50	North Bisect	Special	Soil Sample	flotation sample		4842	C.M./E.W.	05/12/05	Sent for Analysis		
41WB441	7	12	1		1 North	n/a	1	5	40-50	South Bisect	Special	Soil Sample	flotation sample		3213	C.M./E.W.	05/12/05	Sent for Analysis		
41WB441	8	12	1		1 South	n/a	1	5	40-50		Lithic	Burned Rock	burned rock			C.M./E.W.	05/12/05			
41WB441	8	12	1		1 South	n/a	1	5	40-50		Organic	C-14	charcoal	1		C.M./E.W.	05/12/05		BB 1 of 4	Bag 1
41WB441	9	12	1		1 South	n/a	1	5	53		Organic	C-14	charcoal	1	< 1	C.M./E.W.	05/12/05		BB 1 of 4	Bag 1
41WB441	10	14	1		n/a	n/a	1	6	50-60		Lithic	Debitage	debitage	1	1	C.M./E.W.	05/12/05		BB 1 of 4	Bag 1
41WB441	11	1	n/a		n/a	1	n/a	surface	surface		Lithic	Debitage	debitage	10	125	M.R.C.	05/12/05		BB 2 of 4	Bag 1
41WB441	12	1	n/a	1	n/a	1	n/a	surface	surface		Lithic	Proj. Point	Desmuke	1	8	M.R.C.	05/12/05			
41WB441	13	3	n/a		n/a	2	n/a	surface	surface		Lithic	Debitage	debitage	5	2	M.R.C.	05/12/05		BB 2 of 4	Bag 1
41WB441	14	3	n/a	5	n/a	2	n/a	surface	surface		Lithic	Tool	Nueces	1	36	M.R.C.	05/12/05	Nueces biface		
41WB441	15	4	n/a		n/a	3	n/a	surface	surface		Lithic	Debitage	debitage	4	1	J.L./T.N.	05/13/00		BB 2 of 4	Bag 1
41WB441	16	4	n/a	6	n/a	3	n/a	surface	surface		Lithic	Proj. Point	Tortugas	1	5	J.L./T.N.	05/13/00			
41WB441	17	5	n/a		n/a	4	n/a	surface	surface		Lithic	Debitage	debitage	13	10	M.R.C.	05/13/00		BB 2 of 4	Bag 1
41WB441	18	5	n/a	7	n/a	4	n/a	surface	surface		Lithic	Tool	biface - Early Stage	1	22	M.R.C.	05/13/00			
41WB441	19	6	n/a		n/a	5	n/a	surface	surface		Lithic	Debitage	debitage	18	102	J.L./T.N.	05/12/05		BB 2 of 4	Bag 1
41WB441	20	6	n/a	9	n/a	5	n/a	surface	surface		Lithic	Tool	core	1	593	J.L./T.N.	05/12/05			
41WB441	21	7	n/a		n/a	6	n/a	surface	surface		Lithic	Debitage	debitage	104	150	M.R.C.	05/12/05		BB 2 of 4	Bag 1
41WB441	21.1	7	n/a		n/a	6	n/a	surface	surface		Lithic	Tool	Nueces	1	24	M.R.C.	05/12/05			
41WB441	22	8	n/a		n/a	7	n/a	surface	surface		Lithic	Debitage	debitage	51	101	J.L./T.N.	05/12/05		BB 2 of 4	Bag 1
41WB441	22	8	n/a		n/a	7	n/a	surface	surface		Organic	Fauna	mussell shell	1	< 1	J.L./T.N.	05/12/05		BB 1 of 4	Bag 1
41WB441	22.1	8	n/a		n/a	7	n/a	surface	surface		Lithic	Tool	Nueces	1	17	J.L./T.N.	05/12/05			
41WB441	23	16	n/a	2	n/a	n/a	n/a	surface	surface	GPS	Lithic	Tool	biface	1	10	T.N./M.C.	05/13/05	UI 2 - Late Stage		
41WB441	24	17	n/a	3	n/a	n/a	n/a	surface	surface	GPS	Lithic	Tool	biface - Mid Stage	1	8	T.N./M.C.	05/13/00	UI 3 - frag.		
41WB441	25	18	n/a	4	n/a	n/a	n/a	surface	surface	GPS	Lithic	Tool	biface - Mid Stage	1	15	T.N./M.C.	05/13/00	UI 4 - frag.		
41WB441	26	19	n/a	8	n/a	n/a	n/a	surface	surface	GPS	Lithic	Tool	biface - Mid Stage	1	14	T.N./M.C.	05/13/00	UI 8 - frag.		
41WB441	27	15	2	10	n/a	n/a	n/a	Floor	Backdirt	GPS	Lithic	Arrow Point	Fresno	1	1	J.L./T.N.	05/11/05	UI 10-Distal end of possible Fresno arrow point		
41WB441	28	23		21	n/a	n/a	n/a	surface	surface	GPS	Lithic	Arrow Point	Untyped	1	2	M.R.C.	06/12/05	unnamed arrow pt. - L. Prehistoric		
41WB441	29	24		22	n/a	n/a	n/a	surface	surface	GPS	Lithic	Proj. Point	Matamoros	1	2	M.R.C.	06/12/05			
41WB441	30	25		23	n/a	n/a	n/a	surface	surface	GPS	Lithic	Proj. Point	Tortugas	1	9	M.R.C.	06/12/05	Tortugas		
41WB441	31	28		24	n/a	n/a	n/a	surface	surface	GPS	Lithic	Tool	biface	1	34	M.R.C.	06/12/05	Late Stage		
41WB441	32	29		25	n/a	n/a	n/a	surface	surface	GPS	Lithic	Tool	biface	1	5	M.R.C.	06/12/05	fragment - Late Stage		
41WB441	33	20	n/a		n/a	n/a	2	1	0-10		Lithic	Burned Rock	burned rock	3		S.C./E.W.	06/12/05	0-5:3		
41WB441	34	21	n/a		n/a	n/a	2	2	10-20		Lithic	Burned Rock	burned rock	5		S.C./E.W.	06/12/05	0-5:5		
41WB441	34	21	n/a		n/a	n/a	2	2	10-20		Lithic	Debitage	debitage	2		S.C./E.W.	06/12/05			
41WB441	35	27	n/a		3	n/a	2	2	16-20		Organic	C-14	charcoal	1		S.C./E.W.	06/12/05		BB 1 of 4	Bag 1
41WB441	35	27	n/a		3	n/a	2	2	16-20		Special	Soil Sample	feature matrix	1		S.C./E.W.	06/12/05			
41WB441	35	27	n/a		3	n/a	2	2	27-30		Special	Soil Sample	feature matrix	1		S.C./E.W.	06/12/05			
41WB441	36	22	n/a		n/a	n/a	2	3	20-30		Lithic	Debitage	debitage	5		S.C./E.W.	06/12/05			
41WB441	37	26			2	n/a					Lithic	Burned Rock	burned sandstone							
41WB441	37	26			2	n/a	n/a				Special	Soil Sample	feature matrix							
41WB441	38	26			2	n/a				under feature	Special	Soil Sample	matrix							
41WB441	-		1		1	n/a	1	5			Lithic	Burned Rock	burned rock	4		C.M./E.W.	05/12/05	4 bags		
41WB441	-		1		1	n/a	1	5			Special	Soil Sample	feature matrix	2		C.M./E.W.	05/12/05	2 bags		
41WB572	1	9	1				1	1	0-10		Lithic	Burned Rock	FCR	10		EW / SC	5/28/05			
41WB572	1	9	1				1	1	0-10		Lithic	Debitage	debitage	12		EW / SC	5/28/05		BB 1 of 4	Bag 1 of 1
41WB572	2	10	1				1	2	10-20		Lithic	Burned Rock	FCR	6		M.R.C.	5/28/05			

Site	Lot No.	FS No.	BHT	UI No.	Feature	SC No.	Test Unit	Level	Depth (cmbs)	Provenience	Artifact Category	Artifact Type	Artifact Description	No. of Spec.	Weight in grams	Recorders	Date	Comments	Box	Bag
41WB572	2	10	1				1	2	10-20		Lithic	Debitage	debitage	5		M.R.C.	5/28/05		BB 1 of 4	Bag 1 of 1
41WB572	3	11	1				1	3	20-30		Lithic	Burned Rock	FCR	1		M.R.C.	5/28/05			
41WB572	3	11	1				1	3	20-30		Lithic	Debitage	debitage	2		M.R.C.	5/28/05		BB 1 of 4	Bag 1 of 1
41WB572	4	12	1				1	4	30-40		Lithic	Debitage	debitage	1		EW / SC	5/28/05		BB 1 of 4	Bag 1 of 1
41WB572	5	13	2				2	1	0-10		Lithic	Burned Rock	FCR	4		CM / JL	5/28/05			
41WB572	5	13	2				2	1	0-10		Lithic	Debitage	debitage	2		CM / JL	5/28/05		BB 1 of 4	Bag 1 of 1
41WB572	6	14	2				2	2	10-20		Lithic	Burned Rock	FCR	25		CM / JL	5/28/05			
41WB572	6	14	2				2	2	10-20		Lithic	Debitage	debitage	2		CM / JL	5/28/05		BB 1 of 4	Bag 1 of 1
41WB572	7	14	2				2	2	10-20	N 17 E 28	Organic	C-14	charcoal	1		CM / JL	5/28/05		BB 1 of 4	Bag 1 of 1
41WB572	8	15	2				2	3	20-30		Lithic	Burned Rock	FCR	40		CM / JL	5/28/05			
41WB572	8	15	2				2	3	20-30		Lithic	Debitage	debitage	21		CM / JL	5/28/05		BB 1 of 4	Bag 1 of 1
41WB572	9	8			1						Lithic	Burned Rock	FCR	1 bag		M.R.C.	5/27/05			
41WB572	10	8			1						Organic	C-14	charcoal	1		M.R.C.	5/27/05	sample 1	BB 1 of 4	Bag 1 of 1
41WB572	11	8			1				7 cmbd		Organic	C-14	charcoal	1		M.R.C.	5/27/05	sample 2	BB 1 of 4	Bag 1 of 1
41WB572	12	8			1				10 cmbd		Organic	C-14	seeds	4		M.R.C.	5/27/05	sample 3	BB 1 of 4	Bag 1 of 1
41WB572	13	8			1				8 cmbd		Organic	C-14	charcoal	1		M.R.C.	5/27/05	sample 4	BB 1 of 4	Bag 1 of 1
41WB572	14	16			2						Lithic	Burned Rock	FCR			CM / JL	5/29/05			
41WB572	14	16			2						Lithic	Debitage	debitage	1		CM / JL	5/29/05		BB 1 of 4	Bag 1 of 1
41WB572	14	16			2						Special	Soil Sample	feature matrix	4 bags		CM / JL	5/29/05			
41WB572	15	16			2				20 cmbd	N 30 E 55	Organic	C-14	charcoal	1		CM / JL	5/29/05	sample 1	BB 1 of 4	Bag 1 of 1
41WB572	16	16			2						Organic	C-14	charcoal	1		CM / JL	5/29/05	sample 2	BB 1 of 4	Bag 1 of 1
41WB572	17	17			3						Lithic	Burned Rock	FCR			EW / SC	5/29/05			
41WB572	17	17			3						Special	Soil Sample	feature matrix	4 bags		EW / SC	5/29/05			
41WB572	17	17		3	3						Lithic	Tool	Nueces	1	53	EW / SC	5/29/05			
41WB572	18	1		1		1					Lithic	Proj. Point	Tortugas	1	10	S.C.	5/28/05	former Tortugas/Matamoros		
41WB572	19	1				1					Lithic	Debitage	debitage	27	410	S.C.	5/28/05		BB 2 of 4	Bag 1 of 2
41WB572	20	2				2					Lithic	Debitage	debitage	76	417	S.C.	5/28/05		BB 2 of 4	Bag 1 of 2
41WB572	21	3		2		3					Lithic	Tool	biface - Late Stage	1	16	S.C.	5/28/05			
41WB572	22	3				3					Lithic	Debitage	debitage	98	855	S.C.	5/28/05		BB 2 of 4	Bag 1 of 2
41WB572	22.1	3				3					Lithic	Tool	biface - Early Stage	1	145.7	S.C.	5/28/05			
41WB572	22.2	3				3					Lithic	Tool	biface - Early Stage	1	56	S.C.	5/28/05			
41WB572	22.3	3				3					Lithic	Tool	biface - Mid Stage	1	142.5	S.C.	5/28/05			
41WB572	23	4				4					Lithic	Debitage	debitage	90	2794	S.C.	5/28/05		BB 2 of 4	Bag 1 of 2
41WB572	24	5				5					Lithic	Debitage	debitage	3	35	S.C.	5/28/05		BB 2 of 4	Bag 2 of 2
41WB572	25	6				6					Lithic	Debitage	debitage	39	745	S.C.	5/28/05		BB 2 of 4	Bag 2 of 2
41WB572	26	7				7					Lithic	Debitage	debitage	18	914	S.C.	5/28/05		BB 2 of 4	Bag 2 of 2
41WB577	1	19					1	1	0-10		Lithic	Burned Rock	FCR	103		T.N. / J.L.	5/30/05			
41WB577	1	19					1	1	0-10		Lithic	Debitage	debitage	33		T.N. / J.L.	5/30/05		BB 1 of 4	Bag 1 of 1
41WB577	2	20					1	2	10-20		Lithic	Burned Rock	FCR	25		T.N. / J.L.	5/30/05			
41WB577	2	20					1	2	10-20		Lithic	Debitage	debitage	30		T.N. / J.L.	5/30/05		BB 1 of 4	Bag 1 of 1
41WB577	3	21					1	3	20-30		Lithic	Burned Rock	FCR	5		T.N. / J.L.	5/30/05			
41WB577	3	21					1	3	20-30		Lithic	Debitage	debitage	11		T.N. / J.L.	5/30/05		BB 1 of 4	Bag 1 of 1
41WB577	4	22					1	4	30-40		Lithic	Burned Rock	FCR	5		T.N. / J.L.	5/30/05			
41WB577	4	22					1	4	30-40		Lithic	Debitage	debitage	7		T.N. / J.L.	5/30/05		BB 1 of 4	Bag 1 of 1
41WB577	5	23					2	1	0-10		Lithic	Burned Rock	FCR	13		S.C.	5/30/05			
41WB577	5	23					2	1	0-10		Lithic	Debitage	debitage	4		S.C.	5/30/05		BB 1 of 4	Bag 1 of 1
41WB577	6	24					2	2	10-20		Lithic	Burned Rock	FCR	16		S.C.	5/30/05			
41WB577	6	24					2	2	10-20		Lithic	Debitage	debitage	2		S.C.	5/30/05		BB 1 of 4	Bag 1 of 1
41WB577	6.1	24					2	2	10-20		Lithic	Tool	biface - Late Stage	1	2	S.C.	5/30/05	distal frag.		
41WB577	7	25					2	3	20-30		Lithic	Burned Rock	FCR	5		M.R.C.	5/30/05			
41WB577	7	25					2	3	20-30		Lithic	Debitage	debitage	15		M.R.C.	5/30/05		BB 1 of 4	Bag 1 of 1
41WB577	8	26					2	4	30-40		Lithic	Burned Rock	FCR	11		M.R.C.	5/30/05			
41WB577	8	26					2	4	30-40		Lithic	Debitage	debitage	5		M.R.C.	5/30/05		BB 1 of 4	Bag 1 of 1
41WB577	9	48			1		2	5	40-50		Lithic	Burned Rock	FCR	18		M.R.C.	5/31/05			
41WB577	9	48			1		2	5	40-50		Organic	C-14	charcoal	1		M.R.C.	5/31/05		BB 1 of 4	Bag 1 of 1
41WB577	9	48			1		2	5	40-50		Special	Soil Sample	feature matrix	1		M.R.C.	5/31/05			
41WB577	10	30					2	5	40-50		Lithic	Burned Rock	FCR	19		S.C.	5/31/05			
41WB577	10	30					2	5	40-50		Lithic	Debitage	debitage	3		S.C.	5/31/05		BB 1 of 4	Bag 1 of 1
41WB577	11	44					2	6	50-60		Lithic	Burned Rock	FCR	5		M.R.C.	5/31/05			
41WB577	12	46					2	8	70-80		Lithic	Debitage	debitage	1		M.R.C.	5/31/05		BB 1 of 4	Bag 1 of 1
41WB577	13	27	11				3	1	0-10		Lithic	Burned Rock	FCR	27		EW/CM	5/30/05			

Site	Lot No.	FS No.	BHT	UI No.	Feature	SC No.	Test Unit	Level	Depth (cmbs)	Provenience	Artifact Category	Artifact Type	Artifact Description	No. of Spec.	Weight in grams	Recorders	Date	Comments	Box	Bag
41WB577	13	27	11				3	1	0-10		Lithic	Debitage	debitage	30		EW/CM	5/30/05		BB 1 of 4	Bag 1 of 1
41WB577	13	27	11				3	1	0-10		Organic	Fauna	mussell shell	1		EW/CM	5/30/05		BB 1 of 4	Bag 1 of 1
41WB577	13.1	27	11	21			3	1	0-10		Lithic	Tool	biface - Late Stage	1	14		5/30/05	prox. frag.		
41WB577	14	28	11				3	2	10-20		Lithic	Burned Rock	FCR	25		EW/CM	5/30/05			
41WB577	14	28	11				3	2	10-20		Lithic	Debitage	debitage	85		EW/CM	5/30/05		BB 1 of 4	Bag 1 of 1
41WB577	15	29	11				3	3	20-30		Lithic	Burned Rock	FCR	26		EW/CM	5/30/05			
41WB577	15	29	11				3	3	20-30		Lithic	Debitage	debitage	86		EW/CM	5/30/05		BB 1 of 4	Bag 1 of 1
41WB577	16	29	11	22			3	3	20-30	N 38 E 32	Lithic	Tool	biface - Late Stage	1	19	EW/CM	5/30/05	fragment		
41WB577	17	34	8				4	1	0-10		Lithic	Burned Rock	FCR	36		EW/CM	5/30/05			
41WB577	17	34	8				4	1	0-10		Lithic	Debitage	debitage	49		EW/CM	5/30/05		BB 1 of 4	Bag 1 of 1
41WB577	17.1	34	8	26			4	1	0-10		Lithic	Tool	biface - Mid Stage	1	23	EW/CM	5/30/05	rough		
41WB577	18	35	8				4	2	10-20		Lithic	Burned Rock	FCR	46		CM/TN/EW	5/31/05			
41WB577	18	35	8				4	2	10-20		Lithic	Debitage	debitage	60		CM/TN/EW	5/31/05		BB 1 of 4	Bag 1 of 1
41WB577	18	35	8				4	2	10-20		Organic	Fauna	mussell shell	1		CM/TN/EW	5/31/05		BB 1 of 4	Bag 1 of 1
41WB577	18	35	8				4	2	10-20		Organic	Fauna	bone	1		CM/TN/EW	5/31/05		BB 1 of 4	Bag 1 of 1
41WB577	18.1	35	8				4	2	10-20		Lithic	Tool	biface - Mid Stage	1	6.5	CM/TN/EW	5/31/05			
41WB577	19	36	8				4	3	20-30		Lithic	Burned Rock	FCR	15		CM/TN/EW	5/31/05			
41WB577	19	36	8				4	3	20-30		Lithic	Debitage	debitage	36		CM/TN/EW	5/31/05		BB 1 of 4	Bag 1 of 1
41WB577	20	37	8				4	4	30-40		Lithic	Burned Rock	FCR	11		CM/TN/EW	5/31/05			
41WB577	20	37	8				4	4	30-40		Lithic	Debitage	debitage	29		CM/TN/EW	5/31/05		BB 1 of 4	Bag 1 of 1
41WB577	21	38	8				4	5	40-50		Lithic	Burned Rock	FCR	25		CM/TN/EW	5/31/05			
41WB577	21	38	8				4	5	40-50		Lithic	Debitage	debitage	17		CM/TN/EW	5/31/05		BB 1 of 4	Bag 1 of 1
41WB577	21	38	8				4	5	40-50		Organic	Fauna	bone	5		CM/TN/EW	5/31/05		BB 1 of 4	Bag 1 of 1
41WB577	22	39	8				4	6	50-60		Lithic	Burned Rock	FCR	12		JL/TN/EW	5/31/05			
41WB577	22	39	8				4	6	50-60		Lithic	Debitage	debitage	22		JL/TN/EW	5/31/05		BB 1 of 4	Bag 1 of 1
41WB577	22	39	8				4	6	50-60		Organic	Fauna	bone	5		JL/TN/EW	5/31/05		BB 1 of 4	Bag 1 of 1
41WB577	22	39	8				4	6	50-60		Organic	Fauna	mussell shell	2		JL/TN/EW	5/31/05		BB 1 of 4	Bag 1 of 1
41WB577	23	40	8				4	7	60-70		Lithic	Burned Rock	FCR	5		JL/TN/EW	5/31/05			
41WB577	23	40	8				4	7	60-70		Lithic	Debitage	debitage	7		JL/TN/EW	5/31/05		BB 1 of 4	Bag 1 of 1
41WB577	23.1	40	8				4	7	60-70		Lithic	Tool	utilized flake	1	17.5	JL/TN/EW	5/31/05			
41WB577	24	41	8				4	8	70-80		Lithic	Burned Rock	FCR	4		CM/TN/EW	5/31/05			
41WB577	24	41	8				4	8	70-80		Lithic	Debitage	debitage	18		CM/TN/EW	5/31/05		BB 1 of 4	Bag 1 of 1
41WB577	25	42	8				4	9	80-90		Lithic	Burned Rock	FCR	11		CM/TN/EW	5/31/05			
41WB577	25	42	8				4	9	80-90		Lithic	Debitage	debitage	9		CM/TN/EW	5/31/05		BB 1 of 4	Bag 1 of 1
41WB577	25.1	42	8	27			4	9	80-90		Lithic	Tool	biface - Late Stage	1	26	CM/TN/EW	5/31/05	prox. frag.		
41WB577	26	43	8				4	10	90-100		Lithic	Burned Rock	FCR	9		JL/TN/EW	5/31/05			
41WB577	26	43	8				4	10	90-100		Lithic	Debitage	debitage	6		JL/TN/EW	5/31/05		BB 1 of 4	Bag 1 of 1
41WB577	26	43	8				4	10	90-100		Organic	Fauna	bone	9		JL/TN/EW	5/31/05		BB 1 of 4	Bag 1 of 1
41WB577	26	43	8				4	10	90-100		Organic	Fauna	mussell shell	1		JL/TN/EW	5/31/05		BB 1 of 4	Bag 1 of 1
41WB577	27	31	7	25			C.S. 7	1	0-10		Lithic	Tool	biface - Early Stage	1	52	T.N. / J.L.	5/27/05	core flake		
41WB577	28	1		3		1			surface		Lithic	Tool	chopper	1	431	J.L.	5/29/05	core tool w/ cortex		
41WB577	29	1				1					Lithic	Debitage	debitage	2	2	J.L.	5/29/05		BB 2 of 4	Bag 1 of 1
41WB577	30	2		1		2			surface		Lithic	Tool	biface - Late Stage	1	3	C.M.	5/29/05	distal frag.		
41WB577	31	2				2					Lithic	Debitage	debitage	15	188	C.M.	5/29/05		BB 2 of 4	Bag 1 of 1
41WB577	32	3		4		3			surface		Lithic	Tool	biface - Mid Stage	1	26	E.W.	5/29/05	wide rounded sides		
41WB577	33	3				3					Lithic	Debitage	debitage	60	130	E.W.	5/29/05		BB 2 of 4	Bag 1 of 1
41WB577	34	4		5		4			surface		Lithic	Tool	Nueces	1	40	S.C.	5/29/05	course-grained chert		
41WB577	35	4				4					Lithic	Debitage	debitage	13	216	S.C.	5/29/05		BB 2 of 4	Bag 1 of 1
41WB577	35.1	4				4					Lithic	Tool	biface - Mid Stage	1	40.1	S.C.	5/29/05			
41WB577	36	5		6		5			surface		Lithic	Tool	Nueces	1	23	J.L.	5/29/05	w/ cortex gray chert		
41WB577	37	5				5					Lithic	Debitage	debitage	8	15	J.L.	5/29/05		BB 2 of 4	Bag 1 of 1
41WB577	38	6		2		6			surface		Lithic	Tool	biface - Late Stage	1	4	C.M.	5/29/05			
41WB577	39	6				6					Lithic	Debitage	debitage	3	7	C.M.	5/29/05		BB 2 of 4	Bag 1 of 1
41WB577	39.1	6				6					Lithic	Tool	core	1	72.5	C.M.	5/29/05			
41WB577	40	7		7		7			surface		Lithic	Tool	biface - Late Stage	1	2	E.W.	5/29/05	prox. frag.		
41WB577	41	7		15		7			surface		Lithic	Tool	Nueces	1	29	E.W.	5/29/05	yellow chert w/ cortex - plotted in location of UI 7 - SC 7		
41WB577	42	7		16		7			surface		Lithic	Tool	biface - Late Stage	1	17	E.W.	5/29/05	prox. frag. - concave base wide parallel sides		
41WB577	43	7				7					Lithic	Debitage	debitage	8	27	E.W.	5/29/05		BB 2 of 4	Bag 1 of 1

Site	Lot No.	FS No.	BHT	UI No.	Feature	SC No.	Test Unit	Level	Depth (cmbs)	Provenience	Artifact Category	Artifact Type	Artifact Description	No. of Spec.	Weight in grams	Recorders	Date	Comments	Box	Bag
41WB577	44	8		8		8			surface		Lithic	Tool	biface - Late Stage	1	9	S.C.	5/29/05	distal frag. - heat damaged-lanceolate		
41WB577	45	8				8					Lithic	Debitage	debitage	13	90	S.C.	5/29/05		BB 2 of 4	Bag 1 of 1
41WB577	46	9		9		9			surface		Lithic	Tool	uniface	1	27		5/29/05	triangular w/ bulb or perc.		
41WB577	47	9				9					Lithic	Debitage	debitage	1	1	E.W.	5/29/05		BB 2 of 4	Bag 1 of 1
41WB577	48	10		10		10			surface		Lithic	Tool	biface - Mid Stage	1	44	C.M.	5/29/05	thick, convex base		
41WB577	49	10				10					Lithic	Debitage	debitage	1	2	C.M.	5/29/05		BB 2 of 4	Bag 1 of 1
41WB577	50	11		11		11			surface		Lithic	Tool	biface - Late Stage	1	11	J.L.	5/29/05	medial frag.		
41WB577	51	11				11					Lithic	Debitage	debitage	16	40	J.L.	5/29/05		BB 2 of 4	Bag 1 of 1
41WB577	52	12		12		12			surface		Lithic	Tool	biface - Mid Stage	1	65	E.W.	5/29/05	thick and battered		
41WB577	53	12				12					Lithic	Debitage	debitage	58	154	E.W.	5/29/05		BB 2 of 4	Bag 1 of 1
41WB577	54	13		13					surface		Lithic	Tool	biface - Early Stage	1	31	S.C.		red & black		
41WB577	55	14		14					surface		Lithic	Tool	uniface	1	7	S.C.	5/29/05	white quartzite		
41WB577	56	15		17					surface		Lithic	Tool	biface - Mid Stage	1	12	T.N. / J.L.	5/30/05	w/cortex		
41WB577	57	16		18					surface		Lithic	Tool	uniface	1	67	M.R.C.	5/30/05	steep bevel w/ cortex		
41WB577	58	17		19					surface		Lithic	Tool	biface - Mid Stage	1	53	M.R.C.	5/30/05	thick		
41WB577	59	18		20					surface		Lithic	Proj. Point	Totugas	1	8	M.R.C.	5/30/05	concave base		
41WB577	60	32		23					surface		Lithic	Tool	biface - Late Stage	1	< 1	M.R.C.	5/31/05	medial frag.		
41WB577	61	33		24					surface		Lithic	Tool	biface - Late Stage	1	13	M.R.C.	5/31/05	distal frag.		
41WB578	1	7	3		n/a	n/a	1	1	0-10		Lithic	Burned rock	burned rock	38		T.N. / J. L.	05/14/05	0-5:38		
41WB578	1	7	3		n/a	n/a	1	1	0-10		Lithic	Debitage	debitage	29	36	T.N. / J. L.	05/14/05		BB 1 of 4	Bag 1 of 1
41WB578	1	7	3		n/a	n/a	1	1	0-10		Organic	Fauna	mussell shell	1	1	T.N. / J. L.	05/14/05		BB 1 of 4	Bag 1 of 1
41WB578	2	10	3		1	n/a	1	2	10-20		Lithic	Burned rock	burned rock	74		T.N. / J. L.	05/14/05	0-5:68; 5-10: 8; 10-15: 2		
41WB578	2	10	3		1	n/a	1	2	10-20		Lithic	Burned rock	Feature FCR			T.N. / J. L.	05/14/05			
41WB578	2	10	3		1	n/a	1	2	10-20		Lithic	Debitage	debitage	38	41	T.N. / J. L.	05/14/05		BB 1 of 4	Bag 1 of 1
41WB578	3	10	3		1	n/a	1	2	10-20	Eastern 1/2	Special	soil sample	matrix			T.N. / J. L.	05/14/05			
41WB578	4	10	3		1	n/a	1	2	10-20	Western 1/2	Special	soil sample	matrix			T.N. / J. L.	05/14/05			
41WB578	5	10	3		1	n/a	1	2	10-20		Organic	C-14	carbon		21	T.N. / J. L.	05/14/05		BB 1 of 4	Bag 1 of 1
41WB578	6	11	3		n/a	n/a	1	3	20-30		Lithic	Burned rock	burned rock	112		T.N. / J. L.	05/15/05	0-5:105; 5-10:7		
41WB578	6	11	3		n/a	n/a	1	3	20-30		Lithic	Debitage	debitage	48	200	T.N. / J. L.	05/15/05		BB 1 of 4	Bag 1 of 1
41WB578	7	12	3		n/a	n/a	1	4	30-40		Lithic	Burned rock	burned rock	31		T.N. / J. L.	05/15/05	0-5:27; 5-10: 3; 10-15: 1		
41WB578	7	12	3		n/a	n/a	1	4	30-40		Lithic	Debitage	debitage	42	143	T.N. / J. L.	05/15/05		BB 1 of 4	Bag 1 of 1
41WB578	8	18	4		n/a	n/a	2	2	10-20		Lithic	Burned rock	burned rock	23		E.W. / T.N.	05/17/05	0-5:22; 5-10: 1		
41WB578	8	18	4		n/a	n/a	2	2	10-20		Lithic	Debitage	debitage	40	166	E.W. / T.N.	05/17/05		BB 1 of 4	Bag 1 of 1
41WB578	8	18	4		n/a	n/a	2	2	10-20		Fossil	Fauna	shark tooth	1	1	E.W. / T.N.	05/17/05		BB 2 of 4	Bag 1 of 1
41WB578	8	18	4		n/a	n/a	2	2	10-20		Organic	Fauna	mussell shell	1	< 1	E.W. / T.N.	05/17/05		BB 1 of 4	Bag 1 of 1
41WB578	9	19	4		n/a	n/a	2	3	20-30		Lithic	Burned rock	burned rock	5		E.W. / T.N.	05/17/05	0-5: 5		
41WB578	9	19	4		n/a	n/a	2	3	20-30		Lithic	Debitage	debitage	5	< 1	E.W. / T.N.	05/17/05		BB 1 of 4	Bag 1 of 1
41WB578	9.1	19	4	63	n/a	n/a	2	3	20-30		Lithic	Tool	biface - Mid Stage	1	48	E.W. / T.N.	05/17/05			
41WB578	10	20	4		n/a	n/a	2	4	30-40		Lithic	Burned rock	burned rock	7		E.W. / T.N.	05/17/05	0-5:6; 5-10: 1		
41WB578	10	20	4		n/a	n/a	2	4	30-40		Lithic	Debitage	debitage	4	30	E.W. / T.N.	05/17/05		BB 1 of 4	Bag 1 of 1
41WB578	11	21	4		n/a	n/a	2	5	40-50		Lithic	Burned rock	burned rock			E.W. / T.N.	05/17/05			
41WB578	11	21	4		n/a	n/a	2	5	40-50		Lithic	Debitage	debitage	14	80	E.W. / T.N.	05/17/05		BB 1 of 4	Bag 1 of 1
41WB578	12	54	2		n/a	n/a	3	1	0-10		Lithic	Burned rock	burned rock	10		J.L. / C.M.	05/18/05	0-5:10		
41WB578	12	54	2		n/a	n/a	3	1	0-10		Lithic	Debitage	debitage	12	58	J.L. / C.M.	05/18/05		BB 1 of 4	Bag 1 of 1
41WB578	13	55	2		n/a	n/a	3	2	10-20		Lithic	Burned rock	burned rock	75		J.L. / C.M.	05/18/05	0-5:68; 5-10: 7		
41WB578	13	55	2		n/a	n/a	3	2	10-20		Lithic	Debitage	debitage	42	85	J.L. / C.M.	05/18/05		BB 1 of 4	Bag 1 of 1
41WB578	13.1	55	2		n/a	n/a	3	2	10-20		Lithic	Tool	tested cobble	1	135.1	J.L. / C.M.	05/18/05	was labeled biface-really tested cobble		
41WB578	14	55	2	68	n/a	n/a	3	2	29	N 37 E 77	Lithic	Tool	biface - Late Stage	1	5	J.L. / C.M.	05/18/05			
41WB578	15	56	2		n/a	n/a	3	3	20-30		Lithic	Burned rock	burned rock	88		J.L. / C.M.	05/18/05	0-5: 82; 5-10: 6		
41WB578	15	56	2		n/a	n/a	3	3	20-30		Lithic	Debitage	debitage	40	91	J.L. / C.M.	05/18/05		BB 1 of 4	Bag 1 of 1
41WB578	16	57	2		n/a	n/a	3	4	30-40		Lithic	Burned rock	burned rock	95		J.L. / C.M.	05/18/05	0-5: 88; 5-10: 7		
41WB578	16	57	2		n/a	n/a	3	4	30-40		Lithic	Debitage	debitage	26	59	J.L. / C.M.	05/18/05		BB 1 of 4	Bag 1 of 1
41WB578	17	58	2		n/a	n/a	3	5	40-50		Lithic	Burned rock	burned rock	8		J.L. / C.M.	05/18/05	0-5: 5; 5-10: 3		
41WB578	17.1	58	2		n/a	n/a	3	5	40-50		Lithic	Tool	utilized flake	1	3	J.L. / C.M.	05/18/05	fragment		
41WB578	17.2	58	2		n/a	n/a	3	5	40-50		Lithic	Tool	scraper	1	101	J.L. / C.M.	05/18/05			
41WB578	18	93	7		n/a	n/a	4	1	0-10		Lithic	Debitage	debitage	1	3	E.W. / T.N.	05/18/05		BB 1 of 4	Bag 1 of 1
41WB578	19	95	7		n/a	n/a	4	3	20-30		Lithic	Burned rock	burned rock	3		E.W. / T.N.	05/18/05	0-5:3		
41WB578	19	95	7		n/a	n/a	4	3	20-30		Lithic	Debitage	debitage	8	13	E.W. / T.N.	05/18/05		BB 1 of 4	Bag 1 of 1
41WB578	20	97	7		2	n/a	4	3	20-30		Lithic	Burned rock	Feature FCR			E.W. / T.N.	05/18/05			

Site	Lot No.	FS No.	BHT	UI No.	Feature	SC No.	Test Unit	Level	Depth (cmbs)	Provenience	Artifact Category	Artifact Type	Artifact Description	No. of Spec.	Weight in grams	Recorders	Date	Comments	Box	Bag
41WB578	21	97	7		2	n/a	4	3	20-30	Under FCR	Special	soil sample	matrix			E.W. / T.N.	05/18/05			
41WB578	21	97	7		2	n/a	4	3	20-30	Under FCR	Special	soil sample	pollen sample		304	E.W. / T.N.	05/18/05	Sent for Analysis		
41WB578	22	97	7		2	n/a	4	3	20-30	Above FCR	Special	soil sample	matrix			E.W. / T.N.	05/18/05			
41WB578	23	97	7		2	n/a	4	4	30-40		Lithic	Burned rock	burned rock			E.W. / T.N.	05/18/05			
41WB578	24	85	11		n/a	n/a	5	2	10-20		Lithic	Burned rock	burned rock	1		J.L. / E.W.	06/14/05	0-5:1		
41WB578	25	86	11		n/a	n/a	5	3	20-30		Lithic	Burned rock	burned rock	1		J.L. / E.W.	06/14/05	0-5:1		
41WB578	26	87	11		n/a	n/a	5	4	30-40		Lithic	Burned rock	burned rock	35		J.L. / E.W.	06/14/05	0-5:29; 5-10:6		
41WB578	26	87	11		n/a	n/a	5	4	30-40		Lithic	Debitage	debitage	14		J.L. / E.W.	06/14/05		BB 1 of 4	Bag 1 of 1
41WB578	26	87	11		n/a	n/a	5	4	30-40		Special	soil sample	clay (burned)	1		J.L. / E.W.	06/14/05		BB 1 of 4	Bag 1 of 1
41WB578	27	88	11		n/a	n/a	5	5	40-50		Lithic	Burned rock	burned rock	8		Crew	06/14/05	0-5:7; 5-10:1		
41WB578	27	88	11		n/a	n/a	5	5	40-50		Lithic	Debitage	debitage	10		Crew	06/14/05		BB 1 of 4	Bag 1 of 1
41WB578	28	89	11		n/a	n/a	5	6	50-60		Lithic	Debitage	debitage	1		Crew	06/14/05		BB 1 of 4	Bag 1 of 1
41WB578	29	90	11		n/a	n/a	5	7	60-70		Lithic	Debitage	debitage	2		Crew	06/15/05		BB 1 of 4	Bag 1 of 1
41WB578	30	91	11		n/a	n/a	5	8	70-80		Lithic	Burned rock	burned rock	4		Crew	06/15/05	0-5:4		
41WB578	30	91	11		n/a	n/a	5	8	70-80		Lithic	Debitage	debitage	9		Crew	06/15/05		BB 1 of 4	Bag 1 of 1
41WB578	31	1	n/a	1	n/a	1	n/a	Surface	n/a		Lithic	Proj. Point	Langtry	1	4	T.N.	05/15/05			
41WB578	32	1	n/a		n/a	1	n/a	Surface	n/a		Lithic	Debitage	debitage	202	719	T.N.	05/15/05		BB 3 of 4	Bag 1 of 5
41WB578	32.1	1	n/a		n/a	1	n/a	Surface	n/a		Lithic	Tool	tested cobble	1	68	T.N.	05/15/05			
41WB578	32.2	1	n/a		n/a	1	n/a	Surface	n/a		Lithic	Tool	biface - Mid Stage	1	16	T.N.	05/15/05			
41WB578	33	2	n/a	2	n/a	2	n/a	Surface	n/a		Lithic	Proj. Point	Refugio	1	9	M.R.C.	05/17/05	Archiac point - non diag.		
41WB578	34	2	n/a		n/a	2	n/a	Surface	n/a		Lithic	Debitage	debitage	765	1348	M.R.C.	05/15/05		BB 3 of 4	Bag 1 of 5
41WB578	34.3	2	n/a		n/a	2	n/a	Surface	n/a		Lithic	Tool	biface - Mid Stage	1	13	M.R.C.	05/15/05			
41WB578	34.2	2	n/a		n/a	2	n/a	Surface	n/a		Lithic	Tool	Nueces	1	7	M.R.C.	05/15/05			
41WB578	34.1	2	n/a		n/a	2	n/a	Surface	n/a		Lithic	Tool	biface - Mid Stage	1	45	M.R.C.	05/15/05			
41WB578	34.4	2	n/a		n/a	2	n/a	Surface	n/a		Lithic	Tool	biface - Late Stage	1	4.7	M.R.C.	05/15/05			
41WB578	35	3	n/a	3	n/a	3	n/a	Surface	n/a		Lithic	Proj. Point	Tortugas	1	3	S.C.	05/18/05			
41WB578	36	3	n/a	76	n/a	3	n/a	Surface	n/a		Lithic	Tool	biface - Late Stage	1	3	M.R.C.	05/17/05			
41WB578	37	3	n/a		n/a	3	n/a	Surface	n/a		Lithic	Debitage	debitage	303	1185	M.R.C.	05/18/05		BB 3 of 4	Bag 1 of 5
41WB578	37.1	3	n/a		n/a	3	n/a	Surface	n/a		Lithic	Tool	biface - Late Stage	1	3	M.R.C.	05/18/05			
41WB578	37.2	3	n/a		n/a	3	n/a	Surface	n/a		Lithic	Tool	biface - Late Stage	1	12	M.R.C.	05/18/05			
41WB578	37.3	3	n/a		n/a	3	n/a	Surface	n/a		Lithic	Tool	uniface	1	60	M.R.C.	05/18/05			
41WB578	37.4	3	n/a		n/a	3	n/a	Surface	n/a		Lithic	Tool	biface - Mid Stage	1	62	M.R.C.	05/18/05			
41WB578	37.5	3	n/a		n/a	3	n/a	Surface	n/a		Lithic	Proj. Point	Tortugas	1	2	S.C.	05/18/05			
41WB578	37.6	3	n/a		n/a	3	n/a	Surface	n/a		Lithic	Tool	biface - Late Stage	1	5	S.C.	05/18/05			
41WB578	37.7	3	n/a		n/a	3	n/a	Surface	n/a		Lithic	Tool	core	1	107	M.R.C.	05/18/05			
41WB578	38	4	n/a	4	n/a	4	n/a	Surface	n/a		Lithic	Proj. Point	Matamoros	1	6	J.L. / C.M.	05/17/05	former Tortugas/Matamoros		
41WB578	39	4	n/a		n/a	4	n/a	Surface	n/a		Lithic	Debitage	debitage	584	3706	M.R.C.	05/18/05		BB 3 of 4	Bag 2 of 5
41WB578	39.1	4	n/a	61	n/a	4	n/a	Surface	n/a		Lithic	Proj. Point	Tortugas	1	5	M.R.C.	05/18/05	former Tortugas/Matamoros		
41WB578	39.2	4	n/a	62	n/a	4	n/a	Surface	n/a		Lithic	Proj. Point	Tortugas	1	6	M.R.C.	06/13/05	former Tortugas/Matamoros		
41WB578	39.3	4	n/a		n/a	4	n/a	Surface	n/a		Lithic	Tool	biface - Mid Stage	1	111	M.R.C.	05/18/05			
41WB578	39.4	4	n/a		n/a	4	n/a	Surface	n/a		Lithic	Tool	core	1	102	M.R.C.	05/18/05			
41WB578	39.5	4	n/a		n/a	4	n/a	Surface	n/a		Lithic	Tool	biface - Mid Stage	1	73	M.R.C.	05/18/05			
41WB578	39.6	4	n/a		n/a	4	n/a	Surface	n/a		Lithic	Tool	biface - Early Stage	1	31	M.R.C.	05/18/05			
41WB578	39.7	4	n/a		n/a	4	n/a	Surface	n/a		Lithic	Tool	biface - Mid Stage	1	91	M.R.C.	05/18/05			
41WB578	39.8	4	n/a		n/a	4	n/a	Surface	n/a		Lithic	Tool	core	1	179	M.R.C.	05/18/05			
41WB578	40	5	n/a	5	n/a	5	n/a	Surface	n/a		Lithic	Tool	biface - Late Stage	1	8	M.R.C.	05/15/05			
41WB578	41	5	n/a		n/a	5	n/a	Surface	n/a		Lithic	Debitage	debitage	646	2418	M.R.C.	05/15/05		BB 3 of 4	Bag 3 of 5
41WB578	41.1	5	n/a		n/a	5	n/a	Surface	n/a		Lithic	Tool	uniface	1	45	M.R.C.	05/15/05			
41WB578	41.10	5	n/a		n/a	5	n/a	Surface	n/a		Lithic	Tool	biface - Mid Stage	1	6	M.R.C.	05/15/05			
41WB578	41.11	5	n/a		n/a	5	n/a	Surface	n/a		Lithic	Tool	biface - Late Stage	1	9	M.R.C.	05/15/05			
41WB578	41.12	5	n/a		n/a	5	n/a	Surface	n/a		Lithic	Tool	biface - Early Stage	1	32	M.R.C.	05/15/05			
41WB578	41.13	5	n/a		n/a	5	n/a	Surface	n/a		Lithic	Tool	biface	1	59	M.R.C.	05/15/05			
41WB578	41.14	5	n/a		n/a	5	n/a	Surface	n/a		Lithic	Tool	biface - Early Stage	1	14	M.R.C.	05/15/05			
41WB578	41.15	5	n/a		n/a	5	n/a	Surface	n/a		Lithic	Tool	biface - Late Stage	1	< 0.1	M.R.C.	05/15/05			
41WB578	41.16	5	n/a		n/a	5	n/a	Surface	n/a		Lithic	Tool	biface - Early Stage	1	23	M.R.C.	05/15/05			
41WB578	41.17	5	n/a		n/a	5	n/a	Surface	n/a		Lithic	Tool	biface - Mid Stage	1	98	M.R.C.	05/15/05			
41WB578	41.18	5	n/a		n/a	5	n/a	Surface	n/a		Lithic	Tool	biface	1	71	M.R.C.	05/15/05			
41WB578	41.19	5	n/a		n/a	5	n/a	Surface	n/a		Lithic	Tool	biface	1	33	M.R.C.	05/15/05			
41WB578	41.2	5	n/a		n/a	5	n/a	Surface	n/a		Lithic	Tool	utilized flake	1	1	M.R.C.	05/15/05			
41WB578	41.20	5	n/a		n/a	5	n/a	Surface	n/a		Lithic	Tool	biface - Mid Stage	1	19	M.R.C.	05/15/05			
41WB578	41.21	5	n/a		n/a	5	n/a	Surface	n/a		Lithic	Tool	biface	1	104	M.R.C.	05/15/05			

Site	Lot No.	FS No.	BHT	UI No.	Feature	SC No.	Test Unit	Level	Depth (cmbs)	Provenience	Artifact Category	Artifact Type	Artifact Description	No. of Spec.	Weight in grams	Recorders	Date	Comments	Box	Bag
41WB578	41.22	5	n/a		n/a	5	n/a	Surface	n/a		Lithic	Tool	biface	1	19	M.R.C.	05/15/05			
41WB578	41.23	5	n/a		n/a	5	n/a	Surface	n/a		Lithic	Tool	biface	1	57	M.R.C.	05/15/05			
41WB578	41.24	5	n/a		n/a	5	n/a	Surface	n/a		Lithic	Tool	biface	1	40	M.R.C.	05/15/05			
41WB578	41.25	5	n/a		n/a	5	n/a	Surface	n/a		Lithic	Tool	core	1	144	M.R.C.	05/15/05			
41WB578	41.26	5	n/a		n/a	5	n/a	Surface	n/a		Lithic	Tool	core	1	45	M.R.C.	05/15/05			
41WB578	41.27	5	n/a		n/a	5	n/a	Surface	n/a		Lithic	Tool	core	1	58	M.R.C.	05/15/05			
41WB578	41.28	5	n/a		n/a	5	n/a	Surface	n/a		Lithic	Tool	core	1	96	M.R.C.	05/15/05			
41WB578	41.29	5	n/a		n/a	5	n/a	Surface	n/a		Lithic	Tool	core	1	36	M.R.C.	05/15/05			
41WB578	41.3	5	n/a		n/a	5	n/a	Surface	n/a		Lithic	Tool	utilized flake	1	17	M.R.C.	05/15/05			
41WB578	41.4	5	n/a		n/a	5	n/a	Surface	n/a		Lithic	Tool	utilized flake	1	6	M.R.C.	05/15/05			
41WB578	41.5	5	n/a		n/a	5	n/a	Surface	n/a		Lithic	Tool	utilized flake	1	1	M.R.C.	05/15/05			
41WB578	41.6	5	n/a		n/a	5	n/a	Surface	n/a		Lithic	Tool	utilized flake	1	5	M.R.C.	05/15/05			
41WB578	41.7	5	n/a		n/a	5	n/a	Surface	n/a		Lithic	Tool	utilized flake	1	14	M.R.C.	05/15/05			
41WB578	41.8	5	n/a		n/a	5	n/a	Surface	n/a		Lithic	Tool	biface - Mid Stage	1	19	M.R.C.	05/15/05			
41WB578	41.9	5	n/a		n/a	5	n/a	Surface	n/a		Lithic	Tool	utilized flake	1	73	M.R.C.	05/15/05			
41WB578	42	6	n/a	6	n/a	6	n/a	Surface	n/a		Lithic	Tool	Nueces	1	17	M.R.C.	05/17/05			
41WB578	43	6	n/a		n/a	6	n/a	Surface	n/a		Lithic	Debitage	debitage	515	2856	J.L. / C.M.	05/17/05		BB 4 of 4	Bag 5 of 5
41WB578	43.1	6	n/a		n/a	6	n/a	Surface	n/a		Lithic	Tool	uniface	1	30	J.L. / C.M.	05/17/05			
41WB578	43.10	6	n/a		n/a	6	n/a	Surface	n/a		Lithic	Tool	biface	1	79	J.L. / C.M.	05/17/05			
41WB578	43.11	6	n/a		n/a	6	n/a	Surface	n/a		Lithic	Tool	biface - Mid Stage	1	29	J.L. / C.M.	05/17/05			
41WB578	43.12	6	n/a		n/a	6	n/a	Surface	n/a		Lithic	Tool	biface	1	97	J.L. / C.M.	05/17/05			
41WB578	43.13	6	n/a		n/a	6	n/a	Surface	n/a		Lithic	Tool	biface - Mid Stage	1	101	J.L. / C.M.	05/17/05			
41WB578	43.14	6	n/a		n/a	6	n/a	Surface	n/a		Lithic	Tool	biface	1	34	J.L. / C.M.	05/17/05			
41WB578	43.15	6	n/a		n/a	6	n/a	Surface	n/a		Lithic	Tool	biface - Mid Stage	1	17.4	J.L. / C.M.	05/17/05			
41WB578	43.2	6	n/a		n/a	6	n/a	Surface	n/a		Lithic	Tool	Utilized Flake	1	35	J.L. / C.M.	05/17/05			
41WB578	43.3	6	n/a		n/a	6	n/a	Surface	n/a		Lithic	Tool	Utilized Flake	1	18	J.L. / C.M.	05/17/05			
41WB578	43.4	6	n/a		n/a	6	n/a	Surface	n/a		Lithic	Tool	core	1	283	J.L. / C.M.	05/17/05			
41WB578	43.5	6	n/a		n/a	6	n/a	Surface	n/a		Lithic	Tool	core	1	123	J.L. / C.M.	05/17/05			
41WB578	43.6	6	n/a		n/a	6	n/a	Surface	n/a		Lithic	Tool	core	1	77	J.L. / C.M.	05/17/05			
41WB578	43.7	6	n/a		n/a	6	n/a	Surface	n/a		Lithic	Tool	biface - Early Stage	1	24	J.L. / C.M.	05/17/05			
41WB578	43.8	6	n/a		n/a	6	n/a	Surface	n/a		Lithic	Tool	biface - Early Stage	1	55	J.L. / C.M.	05/17/05			
41WB578	43.9	6	n/a		n/a	6	n/a	Surface	n/a		Lithic	Tool	biface - Early Stage	1	30	J.L. / C.M.	05/17/05			
41WB578	44	8	n/a	8	n/a	7	n/a	Surface	n/a		Lithic	Proj. Point	Langtry	1	4	M.R.C.	05/15/05			
41WB578	45	8	n/a	75	n/a	7	n/a	Surface	n/a		Lithic	Proj. Point	Tortugas	1	8	M.R.C.	05/18/05	former Tortugas/Matamoros		
41WB578	46	8	n/a	36	n/a	7	n/a	Surface	n/a		Lithic	Proj. Point	Untyped	1	6	M.R.C.	05/17/05	Former Darl - 9/17/07		
41WB578	47	8	n/a		n/a	7	n/a	Surface	n/a		Lithic	Debitage	debitage	341	1952	J.L. / C.M.	05/17/05		BB 4 of 4	Bag 5 of 5
41WB578	47.1	8	n/a		n/a	7	n/a	Surface	n/a		Lithic	Tool	Utilized Flake	1	8	J.L. / C.M.	05/17/05			
41WB578	47.2	8	n/a		n/a	7	n/a	Surface	n/a		Lithic	Tool	core	1	107	J.L. / C.M.	05/17/05			
41WB578	47.3	8	n/a		n/a	7	n/a	Surface	n/a		Lithic	Tool	biface - Mid Stage	1	6	J.L. / C.M.	05/17/05			
41WB578	47.4	8	n/a		n/a	7	n/a	Surface	n/a		Lithic	Tool	biface - Early Stage	1	37	J.L. / C.M.	05/17/05			
41WB578	47.5	8	n/a		n/a	7	n/a	Surface	n/a		Lithic	Tool	biface - Early Stage	1	59	J.L. / C.M.	05/17/05			
41WB578	47.6	8	n/a		n/a	7	n/a	Surface	n/a		Lithic	Tool	biface - Early Stage	1	72	J.L. / C.M.	05/17/05			
41WB578	48	9	n/a	11	n/a	8	n/a	Surface	n/a		Lithic	Proj. Point	Tortugas	1	8	M.R.C.	05/18/05			
41WB578	49	9	n/a		n/a	8	n/a	Surface	n/a		Lithic	Debitage	debitage	60	378	S.C.	05/18/05		BB 4 of 4	Bag 4 of 5
41WB578	49.1	9	n/a	64	n/a	8	n/a	Surface	n/a		Lithic	Proj. Point	Matamoros	1	4	M.R.C.	05/18/05	former Tortugas/Matamoros		
41WB578	49.2	9	n/a		n/a	8	n/a	Surface	n/a		Lithic	Tool	core	1	115	S.C.	05/18/05			
41WB578	49.3	9	n/a		n/a	8	n/a	Surface	n/a		Lithic	Tool	Utilized Flake	1	12	S.C.	05/18/05			
41WB578	49.4	9	n/a		n/a	8	n/a	Surface	n/a		Lithic	Tool	uniface	1	332	S.C.	05/18/05			
41WB578	49.5	9	n/a		n/a	8	n/a	Surface	n/a		Lithic	Tool	biface - Early Stage	1	19	S.C.	05/18/05			
41WB578	50	13	n/a	27	n/a	9	n/a	Surface	n/a		Lithic	Arrow Point	Caracara	1	2	M.R.C.	05/17/05	Arrow Point		
41WB578	51	13	n/a		n/a	9	n/a	Surface	n/a		Lithic	Debitage	debitage	65	244	S.C.	05/18/05		BB 4 of 4	Bag 4 of 5
41WB578	52	14	n/a	32	n/a	10	n/a	Surface	n/a		Lithic	Proj. Point	Ensor	1	6	M.R.C.	05/17/05			
41WB578	53	14	n/a		n/a	10	n/a	Surface	n/a		Lithic	Debitage	debitage	129	1255	S.C.	05/18/05		BB 4 of 4	Bag 4 of 5
41WB578	53.1	14	n/a		n/a	10	n/a	Surface	n/a		Lithic	Tool	biface - Mid Stage	1	114	S.C.	05/17/05			
41WB578	53.2	14	n/a		n/a	10	n/a	Surface	n/a		Lithic	Tool	biface - Mid Stage	1	52	S.C.	05/17/05			
41WB578	53.3	14	n/a		n/a	10	n/a	Surface	n/a		Lithic	Tool	core	1	120	S.C.	05/17/05			
41WB578	53.4	14	n/a		n/a	10	n/a	Surface	n/a		Lithic	Tool	core	1	129	S.C.	05/17/05			
41WB578	53.5	14	n/a		n/a	10	n/a	Surface	n/a		Lithic	Tool	core	1	181	S.C.	05/17/05			
41WB578	54	15	n/a	33	n/a	11	n/a	Surface	n/a		Lithic	Proj. Point	Tortugas	1	7	M.R.C.	05/17/05	former Tortugas/Matamoros		
41WB578	55	15	n/a		n/a	11	n/a	Surface	n/a		Lithic	Debitage	debitage	138	1548	S.C.	05/17/05		BB 4 of 4	Bag 4 of 5
41WB578	55.1	15	n/a		n/a	11	n/a	Surface	n/a		Lithic	Tool	core	1	70	S.C.	05/17/05			

Site	Lot No.	FS No.	BHT	UI No.	Feature	SC No.	Test Unit	Level	Depth (cmbs)	Provenience	Artifact Category	Artifact Type	Artifact Description	No. of Spec.	Weight in grams	Recorders	Date	Comments	Box	Bag
41WB578	55.3	15	n/a		n/a	11	n/a	Surface	n/a		Lithic	Tool	biface	1	3	S.C.	05/17/05			
41WB578	55.2	15	n/a		n/a	11	n/a	Surface	n/a		Lithic	Tool	biface - Mid Stage	1	43	S.C.	05/17/05			
41WB578	55.4	15	n/a		n/a	11	n/a	Surface	n/a		Lithic	Tool	biface - Mid Stage	1	85	S.C.	05/17/05			
41WB578	56	16	n/a	37	n/a	12	n/a	Surface	n/a		Lithic	Proj. Point	Tortugas	1	7	M.R.C.	05/17/05	former Tortugas/Matamoros		
41WB578	57.1	16	n/a		n/a	12	n/a	Surface	n/a		Lithic	Debitage	debitage	74	738	S.C.	05/17/05		BB 4 of 4	Bag 4 of 5
41WB578	57.2	16	n/a		n/a	12	n/a	Surface	n/a		Lithic	Tool	utilized flake	1	25	S.C.	05/17/05			
41WB578	58	17	n/a	58	n/a	13	n/a	Surface	n/a		Lithic	Proj. Point	Pandora	1	15	M.R.C.	05/17/05	Non - diagnostic		
41WB578	59	17	n/a		n/a	13	n/a	Surface	n/a		Lithic	Debitage	debitage	159	659	S.C.	05/17/05		BB 4 of 4	Bag 4 of 5
41WB578	59.1	17	n/a		n/a	13	n/a	Surface	n/a		Lithic	Tool	utilized flake	1	29	S.C.	05/17/05			
41WB578	59.2	17	n/a		n/a	13	n/a	Surface	n/a		Lithic	Tool	core	1	130	S.C.	05/17/05			
41WB578	59.3	17	n/a		n/a	13	n/a	Surface	n/a		Lithic	Tool	core	1	150	S.C.	05/17/05			
41WB578	59.4	17	n/a		n/a	13	n/a	Surface	n/a		Lithic	Tool	biface - Early Stage	1	30	S.C.	05/17/05			
41WB578	59.5	17	n/a		n/a	13	n/a	Surface	n/a		Lithic	Tool	biface - Mid Stage	1	19	S.C.	05/17/05			
41WB578	60	22	3	12	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	biface - Mid Stage	1	29	J.L. / C.M.	05/14/05			
41WB578	61	41		7	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	biface - Late Stage	1	17	M.R.C.	05/18/05			
41WB578	62	40		9	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	biface - Late Stage	1	5	M.R.C.	05/18/05			
41WB578	63	38		10	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	biface - Mid Stage	1	32	M.R.C.	05/18/05			
41WB578	64	47		13	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	biface - Early Stage	1	63	M.R.C.	05/18/05			
41WB578	65	48		14	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	core	1	84	M.R.C.	05/18/05			
41WB578	66	46		15	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	biface - Mid Stage	1	6	M.R.C.	05/18/05			
41WB578	67	45		16	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	biface - Late Stage	1	13	M.R.C.	05/18/05			
41WB578	68	66		17	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	biface - Mid Stage	1	23	M.R.C.	06/13/05			
41WB578	69	44		18	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	biface - Mid Stage	1	45	M.R.C.	05/18/05			
41WB578	70	43		19	n/a	n/a	n/a	Surface	n/a		Lithic	Proj. Point	Untyped	1	8	M.R.C.	05/18/05	Labeled untyped on 9/14/07 - Steve		
41WB578	71	42		20	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	biface - Late Stage	1	12	M.R.C.	05/18/05			
41WB578	72	64		21	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	biface - Early Stage	1	23	M.R.C.	06/13/05			
41WB578	73	60		22	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	biface - Early Stage	1	31	M.R.C.	06/13/05			
41WB578	74	71		23	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	biface - Late Stage	1	8	M.R.C.	06/13/05			
41WB578	75	73		24	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	utilized Flake	1	5	M.R.C.	06/13/05			
41WB578	76	68		25	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	biface - Early Stage	1	20	M.R.C.	06/13/05			
41WB578	77	72		28	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	core	1	205	M.R.C.	06/13/05			
41WB578	78	61		30	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	core	1	50	M.R.C.	06/13/05			
41WB578	79	62		31	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	biface - Early Stage	1	18	M.R.C.	06/13/05			
41WB578	80	74		34	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	biface - Late Stage	1	5	M.R.C.	06/13/05			
41WB578	81	77		35	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	biface - Early Stage	1	12	M.R.C.	06/13/05			
41WB578	82	50		38	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	biface - Early Stage	1	43	M.R.C.	05/18/05			
41WB578	83	51		39	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	core	1	89	M.R.C.	05/18/05			
41WB578	84	52		40	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	biface - Mid Stage	1	51	M.R.C.	05/18/05			
41WB578	85	49		41	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	biface - Mid Stage	1	49	M.R.C.	05/18/05			
41WB578	86	39		42	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	biface - Late Stage	1	5	M.R.C.	05/18/05			
41WB578	87	67		43	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	biface - Late Stage	1	10	M.R.C.	06/13/05			
41WB578	88	63		45	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	biface - Mid Stage	1	107	M.R.C.	06/13/05			
41WB578	89	35		46	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	core	1	83	M.R.C.	05/18/05			
41WB578	90	26		47	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	biface - Early Stage	1	14	M.R.C.	05/18/05			
41WB578	91	25		48	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	biface - Mid Stage	1	51	M.R.C.	05/18/05			
41WB578	92	24		49	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	biface - Late Stage	1	16	M.R.C.	05/18/05			
41WB578	93	70		49	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	core	1	142	M.R.C.	06/13/05			
41WB578	94	27		50	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	biface - Late Stage	1	9	M.R.C.	05/18/05			
41WB578	95	28		51	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	biface - Late Stage	1	9	M.R.C.	05/15/05			
41WB578	96	29		52	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	biface - Mid Stage	1	20	M.R.C.	05/18/05			
41WB578	97	30		53	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	biface - Late Stage	1	9	M.R.C.	05/17/05			
41WB578	98	31		54	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	biface - Late Stage	1	6	M.R.C.	05/17/05			
41WB578	99	32		55	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	biface - Late Stage	1	6	M.R.C.	05/18/05			
41WB578	100	34		56	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	biface - Late Stage	1	11	M.R.C.	05/18/05			
41WB578	101	33		57	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	biface - Mid Stage	1	18	M.R.C.	05/18/05			
41WB578	102	75		59	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	biface - Mid Stage	1	20	M.R.C.	06/13/05			
41WB578	103	37		60	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	biface - Early Stage	1	8	M.R.C.	05/17/05			
41WB578	104	23		65	n/a	n/a	n/a	Surface	n/a		Lithic	Arrow Point	Caracara	1	2	M.R.C.	05/18/05	Arrow Point		
41WB578	105	36		66	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	biface - Late Stage	1	3	M.R.C.	06/13/05	distal frag.		
41WB578	106	53		67	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	biface - Late Stage	1	13	M.R.C.	05/18/05	distal frag.		
41WB578	107	78		69	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	biface - Early Stage	1	75	M.R.C.	06/13/05			

Site	Lot No.	FS No.	BHT	UI No.	Feature	SC No.	Test Unit	Level	Depth (cmbs)	Provenience	Artifact Category	Artifact Type	Artifact Description	No. of Spec.	Weight in grams	Recorders	Date	Comments	Box	Bag
41WB578	108	79		70	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	core	1	248	M.R.C.	05/18/05			
41WB578	109	80		71	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	core	1	213	M.R.C.	06/13/05			
41WB578	110	82		73	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	biface - Early Stage	1	17	M.R.C.	05/17/05			
41WB578	111	83		74	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	biface - Late Stage	1	4	M.R.C.	06/13/05	fragment		
41WB578	112	98		77	n/a	n/a	n/a	Surface	n/a		Lithic	Tool	uniface	1	100	M.R.C.	06/13/05			
41WB621	1	1				1			surface		Lithic	Tool	core	1	324	C.M.	6/1/2005		in analysis	
41WB621	2	1				1			surface		Lithic	Debitage	debitage	1	56	C.M.	6/1/2005		BB 2 of 4	Bag 1 of 1
41WB621	3	2				2			surface		Lithic	Debitage	debitage	5	28	E.W.	6/1/2005		BB 2 of 4	Bag 1 of 1
41WB621	3.1	2				2			surface		Lithic	Tool	core	1	123	E.W.	6/1/2005		in analysis	
41WB621	3.2	2				2			surface		Lithic	Tool	core	1	89	E.W.	6/1/2005	Bifacially flaked core	in analysis	
41WB621	4	3				3			surface		Lithic	Tool	utilized flake	1	22	C.M.	6/1/2005		in analysis	
41WB621	5	3				3			surface		Lithic	Debitage	debitage	19	410	C.M.	6/1/2005		BB 2 of 4	Bag 1 of 1
41WB621	6	4				4			surface		Lithic	Debitage	debitage	7	82	TN / JL	6/1/2005		BB 2 of 4	Bag 1 of 1
41WB621	6.1	4				4			surface		Lithic	Tool	core	1	71	TN / JL	6/1/2005		in analysis	
41WB621	7	5				5			surface		Lithic	Debitage	debitage	4	49	T.N.	6/1/2005		BB 2 of 4	Bag 1 of 1
41WB621	8	6				6			surface		Lithic	Tool	biface	1	69	E.W.	6/1/2005		in analysis	
41WB621	8.1	6				6			surface		Lithic	Debitage	debitage	7	156	E.W.	6/1/2005		BB 2 of 4	Bag 1 of 1
41WB621	9	7				7			surface		Lithic	Debitage	debitage	14	295	J.L.	6/1/2005		BB 2 of 4	Bag 1 of 1
41WB621	9.1	7				7			surface		Lithic	Tool	core	1	243	J.L.	6/1/2005		in analysis	
41WB621	9.2	7				7			surface		Lithic	Tool	core	1	59	J.L.	6/1/2005		in analysis	
41WB621	10	8		1					surface		Lithic	Tool	core	1	244	S.C.	6/1/2005		in analysis	
41WB622	1	15					1	1	0-10		Lithic	Burned Rock	FCR			C.M. / E.W.	6/8/05			
41WB622	1	15					1	1	0-10		Lithic	Debitage	debitage	7	7	C.M. / E.W.	6/8/05		BB 1 of 4	Bag 1 of 1
41WB622	2	16					1	2	10-20		Lithic	Burned Rock	FCR			C.M. / E.W.	6/8/05			
41WB622	2	16					1	2	10-20		Lithic	Debitage	debitage	9	53	C.M. / E.W.	6/8/05		BB 1 of 4	Bag 1 of 1
41WB622	3	17					1	3	20-30		Lithic	Burned Rock	FCR			C.M. / E.W.	6/8/05			
41WB622	3	17					1	3	20-30		Lithic	Tool	utilized flake	1	9	C.M. / E.W.	6/8/05			
41WB622	4	18					1	4	30-40		Lithic	Burned Rock	FCR			C.M. / E.W.	6/8/05			
41WB622	5	20					2	1	0-10		Lithic	Burned Rock	FCR			C.M. / E.W.	6/7/05			
41WB622	5	20					2	1	0-10		Lithic	Debitage	debitage	4	1	C.M. / E.W.	6/7/05		BB 1 of 4	Bag 1 of 1
41WB622	6	21					2	2	10-20		Lithic	Burned Rock	FCR			M.R.C.	6/7/05			
41WB622	6	21					2	2	10-20		Lithic	Debitage	debitage	3	10	M.R.C.	6/7/05		BB 1 of 4	Bag 1 of 1
41WB622	7	22					2	3	20-30		Lithic	Burned Rock	FCR			M.R.C.	6/7/05			
41WB622	7	22					2	3	20-30		Lithic	Debitage	debitage	3	4	M.R.C.	6/7/05		BB 1 of 4	Bag 1 of 1
41WB622	8	23					2	4	30-40		Lithic	Burned Rock	FCR			M.R.C.	6/7/05			
41WB622	8	23					2	4	30-40		Lithic	Debitage	debitage	3	1	M.R.C.	6/7/05		BB 1 of 4	Bag 1 of 1
41WB622	9	24					2	5	38-48		Lithic	Burned Rock	FCR			M.R.C.	6/8/05			
41WB622	9	24					2	5	38-48		Lithic	Debitage	debitage	1	< 1	M.R.C.	6/8/05		BB 1 of 4	Bag 1 of 1
41WB622	10	14			1				0-13		Lithic	Burned Rock	Feature FCR	1		T.N. / J.L.	6/8/05			
41WB622	10	14			1				0-13		Lithic	Burned Rock	subfeature FCR	1		T.N. / J.L.	6/9/05			
41WB622	10	14			1				0-13		Organic	C-14	charcoal	1		T.N. / J.L.	6/8/05		BB 1 of 4	Bag 1 of 1
41WB622	10	14			1				0-13		Lithic	Debitage	debitage	3	23	T.N. / J.L.	6/8/05	subfeature	BB 1 of 4	Bag 1 of 1
41WB622	10	14			1				0-13		Special	Soil Sample	flotation sample	1		T.N. / J.L.	6/8/05			
41WB622	11	13			2				0-23		Lithic	Burned Rock	burned rock	1		T.N. / J.L.	6/8/05			
41WB622	11	13			2				0-23		Special	Soil Sample	feature matrix	1		T.N. / J.L.	6/8/05			
41WB622	12	13			2				0-23	east side	Organic	C-14	charcoal			T.N. / J.L.	6/8/05	sample 1	BB 1 of 4	Bag 1 of 1
41WB622	13	13			2				0-23	west side	Organic	C-14	charcoal			T.N. / J.L.	6/8/05	sample 2	BB 1 of 4	Bag 1 of 1
41WB622	14	1		1		1			surface		Lithic	Tool	core	1	363	E.W.	6/2/05	crude		
41WB622	15	1				1			surface		Lithic	Tool	core	1	72	E.W.	6/2/05	crude		
41WB622	16	2		2		2			surface		Lithic	Tool	biface - Mid Stage	1	24	J.L.	6/2/05	complete		
41WB622	17	3				3			surface		Lithic	Debitage	debitage	32	42	T.N.	6/2/05		BB 2 of 4	Bag 1 of 1
41WB622	17.1	3				3			surface		Lithic	Tool	utilized flake	1	14	T.N.	6/2/05			
41WB622	17.2	3				3			surface		Lithic	Tool	utilized flake	1	28	T.N.	6/2/05			
41WB622	18	4				4			surface		Lithic	Debitage	debitage	14	19	J.L.	6/2/05		BB 2 of 4	Bag 1 of 1
41WB622	18.1	4				4			surface		Lithic	Tool	utilized flake	1	6	J.L.	6/2/05			
41WB622	18.2	4				4			surface		Lithic	Tool	utilized flake	1	6.5	J.L.	6/2/05			
41WB622	19	5		3		5			surface		Lithic	Tool	biface - Mid Stage	1	8	T.N.	6/2/05			
41WB622	20	5		9		5			surface		Lithic	Tool	biface - Late Stage	1	4	T.N.	6/2/05	prox. Frag.		
41WB622	21	5		11		5			surface		Lithic	Tool	biface - Late Stage	1	16	T.N.	6/2/05	fragment		
41WB622	22	5		10		5			surface		Lithic	Tool	biface - Late Stage	1	9.9	T.N.	6/2/05	prox. Frag.		
41WB622	23	5				5			surface		Lithic	Debitage	debitage	3	2	T.N.	6/2/05		BB 2 of 4	Bag 1 of 1

Site	Lot No.	FS No.	BHT	UI No.	Feature	SC No.	Test Unit	Level	Depth (cmbs)	Provenience	Artifact Category	Artifact Type	Artifact Description	No. of Spec.	Weight in grams	Recorders	Date	Comments	Box	Bag
41WB622	23.1	5				5			surface		Lithic	Tool	utilized flake	1	12	T.N.	6/2/05			
41WB622	24	6		7		6			surface		Lithic	Tool	uniface	1	50	J.L.	6/2/05			
41WB622	25	6				6			surface		Lithic	Debitage	debitage	9	103	J.L.	6/2/05		BB 2 of 4	Bag 1 of 1
41WB622	26	7		4		7			surface		Lithic	Tool	biface - Late Stage	1	6	T.N.	6/2/05	fragment		
41WB622	27	7				7			surface		Lithic	Debitage	debitage	16	49	T.N.	6/2/05		BB 2 of 4	Bag 1 of 1
41WB622	27.1	7				7			surface		Lithic	Tool	utilized flake	1	5	T.N.	6/2/05			
41WB622	28	8		5		8			surface		Lithic	Tool	biface - Late Stage	1	7	J.L.	6/2/05	distal frag.		
41WB622	29	8				8			surface		Lithic	Debitage	debitage	12	18	J.L.	6/2/05		BB 2 of 4	Bag 1 of 1
41WB622	30	9		6					surface		Lithic	Tool	utilized flake	1	30		6/2/05			
41WB622	31	10		8					surface		Lithic	Arrow Point	Caracara	1	1	J.L.	6/2/05	Arrow Point		
41WB622	32	11		12					surface		Lithic	Tool	biface	1	14.4	J.L.	6/2/05	perforator		
41WB622	33	12		13					surface		Lithic	Proj. Point	Tortugas	1	10	J.L.	6/2/05	tortugas		
41WB623	1	13					1	1	0-10		Lithic	Burned rock	FCR	11		KM/CM/EW	6/9/05			
41WB623	1	13					1	1	0-10		Lithic	Debitage	debitage	3		KM/CM/EW	6/9/05		BB 1 of 4	Bag 1 of 1
41WB623	1.1	13					1	1	0-10		Lithic	Tool	utilized flake	1	5	KM/CM/EW	6/9/05			
41WB623	1.2	13					1	1	0-10		Lithic	Tool	utilized flake	1	55.6	KM/CM/EW	6/9/05			
41WB623	2	14					1	2	10-20		Lithic	Burned rock	FCR	6		KM/CM/EW	6/9/05			
41WB623	2	14					1	2	10-20		Lithic	Debitage	debitage	12		KM/CM/EW	6/9/05		BB 1 of 4	Bag 1 of 1
41WB623	3	15					1	3	20-30		Lithic	Burned rock	FCR	23		KM/CM/EW	6/10/05			
41WB623	3	15					1	3	20-30		Lithic	Debitage	debitage	6		KM/CM/EW	6/10/05		BB 1 of 4	Bag 1 of 1
41WB623	4	16					1	4	30-40		Lithic	Burned rock	burned rock	11		KM/CM/EW	6/10/05			
41WB623	4	16					1	4	30-40		Lithic	Debitage	debitage	4		KM/CM/EW	6/10/05		BB 1 of 4	Bag 1 of 1
41WB623	5	17					2	1	0-10		Lithic	Burned rock	FCR	2		KM/CM/EW	6/10/05			
41WB623	5	17					2	1	0-10		Lithic	Debitage	debitage	8		KM/CM/EW	6/10/05		BB 1 of 4	Bag 1 of 1
41WB623	6	18					2	2	10-20		Lithic	Burned rock	FCR	5		KM/CM/EW	6/10/05			
41WB623	6	18					2	2	10-20		Lithic	Debitage	debitage	7		KM/CM/EW	6/10/05		BB 1 of 4	Bag 1 of 1
41WB623	6.1	18					2	2	10-20		Lithic	Tool	core	1		KM/CM/EW	6/10/05			
41WB623	7	18		28			2	2	28 cmbd	N81 E1	Lithic	Tool	biface - Late Stage	1	20	KM/CM/EW	6/10/05	leaf shaped		
41WB623	8	19					2	3	20-30		Lithic	Debitage	debitage	5		CM/EW	6/10/05		BB 1 of 4	Bag 1 of 1
41WB623	9	38					2	4	30-40		Lithic	Burned rock	FCR	3		CM/EW	6/10/05			
41WB623	10	49			3						Lithic	Burned rock	FCR	602		M.R.C.	6/10/05	3 bags		
41WB623	10	49			3						Special	Soil Sample	flotation	1		M.R.C.	6/10/05			
41WB623	11	20			4				0-9		Lithic	Burned rock	FCR	3		J.L. / T.N.	6/10/05	3 bags		
41WB623	11	20			4				0-9		Lithic	Debitage	debitage	2		J.L. / T.N.	6/10/05		BB 1 of 4	Bag 1 of 1
41WB623	11	20			4				0-9		Special	Soil Sample	flotation	1		J.L. / T.N.	6/10/05			
41WB623	12	1		1		1					Lithic	Tool	Nueces	1	43	M.R.C.	6/10/05	w/ cortex		
41WB623	13	1				1					Lithic	Debitage	debitage	6	18	M.R.C.	6/10/05		BB 2 of 4	Bag 1 of 1
41WB623	14	2		2		2					Lithic	Arrow Point	Toyah	1	< 1	M.R.C.	6/10/05	distal fracture - Arrow point		
41WB623	15	2				2					Lithic	Debitage	debitage	4	8	M.R.C.	6/10/05		BB 2 of 4	Bag 1 of 1
41WB623	16	3		3		3					Lithic	Tool	Nueces	1	8	M.R.C.	6/10/05			
41WB623	17	3				3					Lithic	Debitage	debitage	4	43	M.R.C.	6/10/05		BB 2 of 4	Bag 1 of 1
41WB623	18	4		4		4					Lithic	Proj. Point	Refugio	1	17	E.W.	6/10/05	lanceolate - non. Diag.		
41WB623	19	4		27		4					Lithic	Tool	biface - Late Stage	1	3	S.C.	6/10/05	prox. Frag.		
41WB623	20	4				4					Lithic	Debitage	debitage	15	40	M.R.C.	6/10/05		BB 2 of 4	Bag 1 of 1
41WB623	21	5		8		5					Lithic	Tool	Nueces	1	26	M.R.C.	6/11/05	Nueces tool		
41WB623	22	5				5					Lithic	Debitage	debitage	12	10	T.N. / E.W.	6/11/05		BB 2 of 4	Bag 1 of 1
41WB623	23	6		12		6					Lithic	Tool	uniface	1	26	M.R.C.	6/10/05			
41WB623	24	6		13		6					Lithic	Tool	Nueces	1	12	T.N. / E.W.	6/10/05			
41WB623	25	6		30		6					Lithic	Tool	Nueces	1	18	E.W.	6/10/05	steep bevel		
41WB623	26	6				6					Lithic	Debitage	debitage	30	156	E.W.	6/11/05		BB 2 of 4	Bag 1 of 1
41WB623	27	7				7					Lithic	Debitage	debitage	71	43	E.W.	6/11/05		BB 2 of 4	Bag 1 of 1
41WB623	27.1	7				7					Lithic	Tool	utilized flake	1	61.8	E.W.	6/11/05			
41WB623	28	8		15		8					Lithic	Tool	Nueces	1	16	C.M.	6/11/05	Nueces tool		
41WB623	29	8				8					Lithic	Debitage	debitage	8	219	C.M.	6/11/05		BB 2 of 4	Bag 1 of 1
41WB623	30	9		16		9					Lithic	Tool	biface - Mid Stage	1	13	C.M.	6/11/05			
41WB623	31	9				9					Lithic	Debitage	debitage	3	72	C.M.	6/11/05		BB 2 of 4	Bag 1 of 1
41WB623	31.1	9				9					Lithic	Tool	core	1	397.9	C.M.	6/11/05	Tested cobble?		
41WB623	31.2	9				9					Lithic	Tool	core	1	81.6	C.M.	6/11/05			
41WB623	32	10		29		10					Lithic	Tool	biface - Late Stage	1	16	S.C.	6/11/05	prox. frag. - parallel sides		
41WB623	33	10				10					Lithic	Debitage	debitage	59	116	S.C.	6/11/05		BB 2 of 4	Bag 1 of 1
41WB623	34	11		37		11					Lithic	Tool	biface - Late Stage	1	2	M.R.C.	6/11/05	prox. Frag.		

Site	Lot No.	FS No.	BHT	UI No.	Feature	SC No.	Test Unit	Level	Depth (cmbs)	Provenience	Artifact Category	Artifact Type	Artifact Description	No. of Spec.	Weight in grams	Recorders	Date	Comments	Box	Bag
41WB623	35	11				11					Lithic	Debitage	debitage	141	165	E.W.	6/11/05		BB 2 of 4	Bag 1 of 1
41WB623	35.1	11				11					Lithic	Tool	biface - Mid Stage	1	36	E.W.	6/11/05			
41WB623	36	12				12					Lithic	Debitage	debitage	14	116	C.M.	6/11/05		BB 2 of 4	Bag 1 of 1
41WB623	36.1	12				12					Lithic	Tool	core	1	418.8	C.M.	6/11/05			
41WB623	36.2	12				12					Lithic	Tool	utilized flake	1	17.6	C.M.	6/11/05			
41WB623	37	46				13					Lithic	Debitage	debitage	69	49	T.N. / E.W.	6/11/05		BB 2 of 4	Bag 1 of 1
41WB623	38	21		5							Lithic	Tool	Nueces	1	12	S.C.	6/10/05	battered		
41WB623	39	22		6							Lithic	Tool	biface - Mid Stage	1	44	M.R.C.	6/10/05	chunky		
41WB623	40	23		7							Lithic	Groundstone	mano	1	189	M.R.C.	6/10/05	possible mano?		
41WB623	41	24		9							Lithic	Tool	biface - Late Stage	1	3	S.C.	6/10/05	prox. Frag		
41WB623	42	25		10							Lithic	Tool	Nueces	1	13	M.R.C.	6/10/05			
41WB623	43	26		11							Lithic	Tool	biface - Early Stage	1	37	M.R.C.	6/10/05	heat treated-chunky		
41WB623	44	27		14							Lithic	Tool	biface	1	166	M.R.C.	6/10/05	core tool		
41WB623	45	28		17							Lithic	Tool	uniface	1	38	M.R.C.	6/10/05	minimal mod.		
41WB623	46	29		18							Lithic	Tool	Nueces	1	21	M.R.C.	6/10/05			
41WB623	47	30		19							Lithic	Tool	biface - Mid Stage	1	31	M.R.C.	6/10/05	steep bevel		
41WB623	48	31		20							Lithic	Tool	biface - Late Stage	1	4	M.R.C.	6/10/05	distal frag.		
41WB623	49	32		21							Lithic	Tool	Nueces	1	24	M.R.C.	6/10/05	Nueces tool		
41WB623	50	33		22							Lithic	Tool	biface - Early Stage	1	72	M.R.C.	6/10/05	crude w/ cortex		
41WB623	51	34		23							Lithic	Tool	biface - Early Stage	1	47	M.R.C.	6/10/05	crude, battered		
41WB623	52	35		24							Lithic	Tool	biface - Late Stage	1	4	M.R.C.	6/10/05	prox. Frag.		
41WB623	53	36		25							Lithic	Tool	biface - Mid Stage	1	50	M.R.C.	6/10/05	crude		
41WB623	54	37		26							Lithic	Tool	Nueces	1	10	M.R.C.	6/10/05	Nueces tool		
41WB623	55	39		31							Lithic	Tool	biface - Late Stage	1	19	S.C.	6/11/05	prox. Frag		
41WB623	56	41		32							Lithic	Proj. Point	Untyped	1	9	E.W.	6/11/05	Former Refugio/Desmuke		
41WB623	57	42		33							Lithic	Proj. Point	Untyped	1	8	S.C.	6/11/05	distal frag. - non diag.		
41WB623	58	43		34							Lithic	Tool	Nueces	1	15	S.C.	6/11/05	battered		
41WB623	59	44		35							Lithic	Tool	biface - Late Stage	1	5	S.C.	6/11/05	fragment		
41WB623	60	45		36							Lithic	Tool	biface - Mid Stage	1	114	E.W.	6/11/05	crude w/ cortex		
41WB578	113.1				n/a	14	n/a	Surface	n/a		Lithic	Tool	Biface	1	10.8	EW	11/2/2005			
41WB578	113.2				n/a	14	n/a	Surface	n/a		Lithic	Tool	core	1	33.2	EW	11/2/2005			
41WB578	114.1				n/a	15	n/a	Surface	n/a		Lithic	Tool	Biface	1	23.3	EW	11/2/2005			
41WB578	114.2				n/a	15	n/a	Surface	n/a		Lithic	Tool	core	1	128.3	EW	11/2/2005			
41WB578	116.1				n/a	17	n/a	Surface	n/a		Lithic	Tool	Biface	1	88.5	SC	11/2/2005			
41WB578	116.2				n/a	17	n/a	Surface	n/a		Lithic	Tool	core	1	159.6	SC	11/2/2005			
41WB578	116.3				n/a	17	n/a	Surface	n/a		Lithic	Tool	core	1	77.2	SC	11/2/2005			
41WB578	116.4				n/a	17	n/a	Surface	n/a		Lithic	Tool	core	1	60.3	SC	11/2/2005			
41WB578	116.5				n/a	17	n/a	Surface	n/a		Lithic	Tool	core	1	165.6	SC	11/2/2005			

Site	Context	No. of Nueces tools	Max Level of Work	Temporal Components Identified on Site					Ecological/Economic Zone	Drainage Basin
				Early Middle Archaic	Late Middle Archaic	Late Archaic	Late Transitional Archaic	Late Prehistoric		
41WB9	Surface	1	T		LMA	LA	TA	LP	Tributary Riparian	Chacon Creek
41WB16	Surface	1	T						Riverine Riparian	Rio Grande
41WB23	Surface	?	T		LMA	LA				Rio Grande River
41WB71	Surface	1	S		LMA	LA				Rio Grande
41WB101	Subsurface	1	T		LMA	LA	TA		Ecotonal	Arroyo de los Angeles
41WB130	Surface	6	no data							
41WB212	Surface and Subsurface	5	T		LMA				Upland	Rio Grande
41WB219	Surface	7	T		LMA			LP	Riverine/Tributary Riparian	Rio Grande
41WB236	Surface	2	S		LMA		TA	LP	Upland	Rio Grande
41WB268	Surface	1	S						Upland	Rio Grande
41WB269	Surface	5	S						Tributary Riparian	Rio Grande
41WB271	Surface	1	S						Ecotonal	Rio Grande
41WB272	Surface	5	S		LMA		TA	LP	Upland	Rio Grande
41WB295	Surface	1	S		LMA			LP	Upland	Tordillo and Carrizitos Creek
41WB302	Surface	1	S						Upland	Tordillo Creek
41WB303	Surface	1	T			LA			Upland	Tordillo and Tejones Creek
41WB310	Surface	10	T		LMA				Upland	Tordillo Creek
41WB310	Surface	5	T		LMA				Upland	Tordillo Creek
41WB314	Surface	3	T		LMA				Tributary Riparian	Santa Isabel Creek
41WB316	Surface	1	T		LMA			LP	Upland	Tordillo and Tejones Creeks
41WB324	Surface	1	T		LMA				Tributary Riparian	Tejones Creek
41WB329	Surface	1	T		LMA	LA			Upper Tributary Riparian	Rio Grande River.
41WB329	Surface	4	T		LMA	LA			Upper Tributary Riparian	Rio Grande River.
41WB336	Surface	1	S					LP	Upland	Tordillo Creek
41WB363	Surface	2	T		LMA	LA	TA		Upper Tributary Riparian	Rio Grande
41WB363	Subsurface	1	T		LMA	LA	TA		Upper Tributary Riparian	Rio Grande
41WB364	Surface	2	S		LMA		TA	LP	Upland	Rio Grande
41WB364	Surface	2	S		LMA		TA	LP	Upland	Rio Grande
41WB366	Surface	2	S		LMA			LP	Upland	Rio Grande
41WB368	Surface	1	S		LMA	LA	TA		Upland	Rio Grande
41WB377	Surface	1	S				TA		Tributary Riparian	Manadas Creek

Site	Context	No. of Nueces tools	Max Level of Work	Temporal Components Identified on Site					Ecological/Economic Zone	Drainage Basin
				Early Middle Archaic	Late Middle Archaic	Late Archaic	Late Transitional Archaic	Late Prehistoric		
41WB379	Surface	2	S		LMA		TA		Ecotonal	Manadas Creek
41WB397	Surface	1	S					LP	Upland	Chacon Creek
41WB416	Subsurface	1	T						Riverine Riparian	Rio Grande
41WB437	Subsurface	3	D		LMA		TA		Lower Tributary Riparian	San Idelfonso Creek
41WB438	Surface	1	D		LMA				Tributary Riparian	San Idelfonso Creek.
41WB448	Surface	1	S		LMA		TA		Upland	Rio Grande
41WB487	Surface	3	S						Upland	Rio Grande
41WB488	Surface	1	S		LMA		TA		Upland	Rio Grande
41WB557	Subsurface	11	D	MA	LMA	LA	TA	LP	Tributary Riparian	Becerra Creek
41WB563	Surface	N/a	S		LMA	LA	TA		Upper Tributary Riparian	Santa Isabel Creek
41WB565	Surface	2	S		LMA				Riverine Riparian	Rio Grande
41WB571	Surface	1	S		LMA				Upland	Chacon Creek
41WB577	Surface	2	T		LMA			LP	Tributary Riparian	San Idelfonso Creek
41WB613	Surface	N/a	T		LMA			LP	Upland	Rio Grande
41WB623	Surface and subsurface	6	T							Rio Grande